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ABSTRACT

This annotated bibliography provides journal references on how children learn mathematics and about diagnostic and remedial techniques for teaching mathematics, particularly at the elementary school level. A large number of the articles report research in diagnostic and prescriptive mathematics. (MNS)

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AN ANNOTATED BIBLIOGRAPHY OF PERIODICAL ARTICLES RELATING TO THE DIAGNOSTIC AND PRESCRIPTIVE INSTRUCTION OF MATHEMATICS

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FORWARD

The preparation of an annotated bibliography can not possibly be accomplished without the assistance of many professional educators who are willing to donate their time and effort to research each entry in the manuscript. Each of the following mathematics educators has contributed to this bibliography:

Anna O. Baxter
Suzanne Provencher
Lelcn R. Capps
Grace M. Burton
Cecil R. Trueblood
Robert Sovchik
Darleen Pigford
Mary Ann Rossi
Linda Zimmerman
Ed Uprichard
Gayle S. Johnson
Leroy Callahan
Robert Ashlock
Douglas Edge
Karen A. Verbeke
Karen L. Gladden
Tom Romberg
Janet Green
Frances Kelly
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Carol F. Nouvillis
Janet Baldwin
Richard Weinsier
Janet K. Scheer
Greg Baur
Kathryn Kemmer
Stephanie Rossi
Charles Goodall
Robert G. Underhill
Theresa A. Barrie
Martha Gage
Deborah Ambrose
Gail Sorenson
Tom Denmark
Ralph Connelley
Martha Moyer
Paul Scott
Halden L. Anderson

A sincere "thank you" is extended to each of these persons.

Michael C. Hynes
Editor

Alpert, Richard and Haber, Ralph N., Anxiety in academic achievement situations. Journal of Abnormal and Social Psychology, 1970, 61, 207-215.

Anxiety has two facets: debilitating and facilitating. The use of a general anxiety scale is not appropriate for measuring a specific anxiety such as math anxiety. Specific scales which measure each type of anxiety and which can be used to predict academic performance in mathematics are suggested.

(Grace M. Burton)

Aiken, Lewis R. Update on attitudes and other affective variables in learning mathematics. Review of Educational Research, 1976, 46, 293-311.

An excellent review of the state of the art to 1976. The 8-page bibliography is a fine starting-point for anyone wishing to do some reading in the areas of mathematics anxiety, the effects of teacher attitudes towards mathematics, and variation in attitude due to sex. *(Grace M. Burton)*

Ashlock, R. Model switching: A consideration in the teaching of subtraction and division of whole numbers. School Science and Mathematics, 1977, 77, 327-334.

The article considers model switching in two whole number operations: subtraction and division. In each operation two models are discussed:

1. Subtraction
   a. The take away model b. The comparison model
2. Division
   a. The measurement model b. The partitive model

(Linda Zimmerman)

Austin, Gilbert R., Rogers, Bruce G., & Walbesser, Henry H., Jr. The effectiveness of summer compensatory education: A review of the research. Review of Educational Research, 1972, 42, 171-181.

This review is concerned with the Summer Compensatory Education Program component of the Title I section of the Elementary and Secondary Education Act of 1965, with particular emphasis on educationally deprived children. It dealt with publicly available reports relating to compensatory education and presenting evidence in the form of empirical data. Sections of this review included: historical notes on summer shcool, growth in cognitive areas, noncognitive variables, cost data, and conclusions and recommendations. *(Karen A. Verbeke)*

Austin, Joe Dan, Do comments on mathematics homework effect student achievement? School Science and Math, 1976, 76, 159-64.

No difference in student achievement was noticed within the six week experiment. It may be a waste of the teachers time to grade every problem on every assignment.

Six weeks may not have been long enough to develop accurate results. There could be a difference in the type of math (algebra, general math, geometry) as to the motivation needed. *(G. Baur, D. Pigford)*

Bachman, Alfred M. The relationship between a seventh-grade pupil's academic self-concept and achievement in mathematics. Journal for Research in Mathematics Education, 1970, 1, 173-179.

This study attempted to determine the relationship between mathematics self-concept and mathematics achievement with a sample of 404 seventh-grade students in the Portland, Oregon Public Schools. A significant relationship was found between self-concept of ability in mathematics and mathematics achievement. For the specific self-concept measures used, mathematics self-concept was found to be the best predictor of mathematics achievement. (*Karen A. Verbeke*)

Bachman, Alfred M. Some suggestions for motivating students in general mathematics classes. The Mathematics Teacher, 1971, 64, 651-659.

This report attempted to describe ways of motivating educationally deprived high school students in general mathematics classes. The model described in this report was a summer workshop program implemented in the Philadelphia School District. Objectives were outlined as well as four phases, including the nature of the student, content and strategy, development and implementation, and evaluation. Specific suggestions were included. (*Karen A. Verbeke*)

Barcott, Richard A. Time-telling instruction in special education classes. Education and Training of the Mentally Retarded. 1972, 8, 107-11.

The article dealt with a study on the effectiveness of an individualized time-telling program. The study involved students from five special education classes from four schools (3 intermediate classes and two junior high classes). A total of 16 students were chosen after meeting criteria used. There were a total of seven phases in this program. The program was entitled "What Time Is It?". It uses 56 second grade level words repetitiously and stated what each phase consisted of. A criterion referenced test was used in analyzing the pre and post test data. The criterion set for this study was not reached, but there were tables indicating successful gain scores of the tests. (*Janet M. Baldwin*)

Bassham, Harrell; Murphy, Michael; & Murphy, Katherine. Attitude and achievement in arithmetic. The Arithmetic Teacher, 1964, 11, 66-72.

On a basis of a study of 159 sixth grade pupils, the authors conclude "A child may be very certain that it would be to his advantage to master a given subject. He may even be curious about the matter and may even be willing to spend a great deal of time and effort attempting to learn, but in his heart he expects to fail, that child works at a serious disadvantage. (*Grace M. Burton*)

Beardslee, E., et al. Teaching for generalization: An array approach to equivalent fractions. The Arithmetic Teacher, 1973, 21, 591-599.

The authors in this article are teaching equivalent fractions using colored chips or shaded areas in arrays. It is expected upon a successful conclusion of this lesson that a generalization can be made to find any equivalent fraction of an original primitive fraction. The authors set up 3 objectives and tests to be passed to show competency in this area. (*Richard Weinsier*)

Beatty, W.W. The additive versus the borrowing method of subtraction. Elementary School Journal, 1920, 21(3), 198-200.

This article discusses the use of the Austrian or additive method of subtraction as taught in two school systems. In the New York Schools after having been taught exclusively for seven years, it was found that less than half were using the additive method; more were using the "Borrowing" method supposedly excluded from the curriculum. In the San Francisco Schools, it was found that 50% had abandoned the additive and were using the borrowing method. Test results showed that those employing the additive method were slower but more accurate. The question arise then what could those using the borrowing method have done if they had been taught that from the beginning. *(S. Provencher)*

Bradley, Betty H. and Hundziak, M.. TMI-Grolier time telling program for the mentally retarded. Exceptional Children, 1965, 32(1), 17-20.

The authors explain an experiment using a teaching machine to teach retarded children to tell time. Observations by the teacher indicate some handicaps of retarded children: 1) visual motor areas, 2) auditory problems, and 3) reading difficulties. Learning problems of the retarded were easily and clearly identified during the Teaching Machine Program. It appeared that use of a teaching machine to help retarded children learn to tell time was useful and relatively inexpensive. *(Mary Ann Rossi)*

Brownell, William A. The place of "crutches" in instruction. The Elementary School Journal, 1934, 34, 607-619.

Investigation of children's difficulty in adding proper fractions with reference to using "crutches" and not using "crutches". (term "crutch" should undoubtedly be eliminated from the educational vocabulary; poor selection of term) Results: 1) children using "crutches" learned to add fractions about as well as childred who used no "crutch"; 2) no difference between two groups as to the total number of faults; 3) children taught with "crutches" were no less capable of developing mature forms of skill in adding fractions; 4) majority of children taught with a "crutch" discarded it in less than four months from its introduction; 5) not all children adopted a new method to take the place of the "crutch"; 6) some children continued use of "crutch" even after it had lost its value as a learning tool. Totally, whether or not to use "crutches" is dependent on whether they facilitate or interfere with the learning. (teacher judgement)

(Stephanie Rossi)

Bradley, Betty H. Responses of retarded children on three and two dimensional visual tasks. Exceptional Children, 1969, 36(3), 165-170.

A comparison of performance of two groups of mentally retarded children paired on perceptual functioning in relation to visual motor tasks, CA, MA, and I.Q. Subjects with severe motor handicaps scored significantly lower. Illustrates the necessity for differentiation of teaching materials and task analysis in order to meet individual needs -- especially of the mentally retarded. *(Kathryn Kemmer)*

Brownell, William A. The progressive nature of learning in mathematics. The Mathematics Teacher, 1944, 37, 147-157.

In the author's opinion, learning as connection-forming has not been helpful to teachers. He points out and elaborates on four instructional weak-

nesses in mathematics; i.e., process vs. product; over-rapid instruction; faulty practice; and remedial teaching. He calls for substituting progressive reorganization which emphasizes the essential continuity of learning in an unhurried way. (*T. Bauman*)

Burns, Paul C., and Arnold R. Davis. Early research contributions to elementary school mathematics. The Arithmetic Teacher, 1970 17(1), 61-65.

Summarizes 34 pioneer researches on elementary school mathematics, published between 1919 and 1947, that touch on these topics: (a) beginning instruction, (b) content selection, (c) role of drill and practice, (d) basic operations, (e) problem solving, (f) readability and vocabulary, (g) disability, (h) history and summaries of research. Research on disability is highlighted by the 1925 study of G. T. Buswell and Lenore John who attempted to catalog pupils' operational habits in each of the operations, and Peter L. Spencer's study of 1929-30, one of the early efforts to identify typical student errors in mathematics. All of the research cited was influenced by research in related areas; all had impact because they were closely related to the problems of the day. (*Baxter & Graeker*)

Burton, Grace M. Mathematical ability - is it a masculine trait. School Science and Mathematics, 1978, 78, 566-574.

The author examines sex differences in mathematicsl ability in relation to biological factors, cultural pressures, and sex-role identification. Recommendations for increasing mathematics achievement in females are offered.

Callahan, John J. and Jacobson, Ruth S. An experiment with retarded children and cuisenaire rods. Arithmetic Teacher, 1967, 14, 10-13.

The aritcle described a nine week arithmetic learning activity with 7 - 10 year old special class students ranging in IQ from about 75 to 50 using Cuisenaire Rods. Instructional procedures used during introductory stages as well as during the specific arithmetic instruction stage are explained. A few typical individual cases of learning using the materials are described. The teacher's observations and evaluation of students' progress using Cuisenaire materials are presented. (*L. Callahan*)

Callahan, Leroy G. Remedial work with underachieving children. Arithmetic Teacher, 1962, 9, 138-140.

The under/over achievement patterns of an eighth grade population from an inner-city school were examined in arithmetic, reading, and general achievement. Students above the mean IQ were generally underachieving while those below the mean were generally overachieving. Twenty students with a high discrepancy between their mental age (high) and arithmetic achievement (low) were then chosen to participate in the remedial experiment. Ten received special remedial work over a 3 month period, ten did not. At the conclusion of the experimental period, the discrepancy scores of the ten in remediation were cut in half; the ten controls were underachieving more. The content and remedial procedures were described, and suggestions made for classroom teachers.(*L. Callahan*)

Callahan, Leroy G. Test-item tendencies: Curiosity and caution. Arithmetic teacher, 1977, 25, 10-13.

This article reports on an analysis of responses to test items from a standardized achievement test in mathematics by first-grade students. Ten

items are presented, and response tendencies of students considered. The validity of certain items on standardized tests in measuring stated objec tives is discussed. It is suggested that studying response tendencies of students to items may contribute to a healthy caution in interpreting test results for either formative or summative evaluation purposes.

(*L. Callahan*)

Callahan, Leroy & Passi, Sneh Lata. Textbooks, transitions, and transplants. Arithmetic Teacher, 1972, 19, 381-385.

The article includes the report of a study of the cognitive processes typically fostered by an elementary school mathematics textbook series. Seven levels of cognitive processes were used; knowing, translating, manipulating, choosing, analyzing, synthesizing, evaluating. Three different textbook series (2 current, 1 older) from grade levels three, four, five, and six were used in the analysis. More than 50 percent of the cognitive activities fostered by the textbooks were classified at the manipulative level; none of the textbooks tended to foster higher level cognitive processes. Some particular differences in textbooks were presented, and some suggestions on program inclusions. (*L. Callahan*)

Capie, William & Jones, Howard. An assessment of hierarchy validation techniques. Journal of Research in Science Teaching, 1971, 8, 137-147.

This research reports on validation techniques associated with a Gagneian model of hierarchial learning. Four terminal behaviors, with prerequisite skills, about specific gravity were described in behaviorally testable form. Evaluation instruments were developed to evaluate each behavior for each student. Consistency, adequacy, and necessity ratios which compared portions of subjects' performance relative to postulated immediate behavior pairs were statistically analyzed. Application of the procedure to behavior pairs other than those postulated revealed that many other dependency relations do exist. This suggests the complexity of learning hierarchies and the further study of specific hierarchies to aid in curriculum development. (*L. Callahan*)

Caplan, Paula J. Sex, age, behavior, and school subject as determinants of report of learning problems. Journal of Learning Disabilities, 1977, 10, 60-62.

Two hundred eighty college students were asked to establish priorities for assigning tutorial help for children. Most likely to be referred were older boys who had difficulty in reading. Least likely to be referred were younger girls having difficulty in arithmetic. (*Grace M. Burton*)

Capps, Lelon A. A comparison of superior achievers and underachievers in arithmetic. The Elementary School Journal, 1962, 63, 141-145.

Article examined characteristics of children who were accelerated or retarded in arithmetic achievement. Tests used were SRA Achievement Series, California Test of Personality, and California Test of Mental Maturity. Results: 1) no difference in scores of personality inventory between superior achievers and underachievers; 2) relationship of intelligence to arithmetic achievement for either sex; 3) good work habits do not result in superior arithmetic achievement; 4) girls receive higher scores on personality tests than boys because they mature earlier; 5) retardation in arithmetic tends to be related to personal

adjustment (emotional difficulties); 6) I.Q. was average for underachiever, therefore cause of arithmetic retardation may be in the area of instruction. (*Stephanie R[illegible]vi*)

Carpenter, Thomas P., et. al. Notes from national assessment: Perimeter and area. The Arithmetic Teacher, 1975, 22(8), 586-590.

Based on studies by the National Assessment of Educational Progress and state assessments of Florida, Wisconsin and Michigan, it is concluded that by the time they reach junior high school, most students are capable of only simple measurement problems which they perform in a rote, superficial manner with little understanding of the procedures to be used. In order to increase their ability to deal with measurement, it is recommended that students should: (a) be taught to draw a picture of the figure that is under consideration, to help them visualize what is to be done; (b) be given the opportunity to verbalize plans for solving the problem; (c) be encouraged to check their answers to see if they make sense. The purpose of the above steps is to encourage students to think about measurement as a problem-solving situation rather than mechanical drill. If, in addition, they have a variety of such problems, students will be given a more meaningful treatment of measurement situations. They are also provided valuable experience with general problem-solving strategies. (*Baxter & Graeber*)

Carpenter, Thomas P., et. al. Subtraction: What do students know? The Arithmetic Teacher, 1975, 22(9), 653-657.

The authors report national performance levels of various groups on selected subtraction problems used in the 1972-73 mathematics assessment of the National Assessment of Educational Progress. NAEP results indicate that most students master basic subtraction with regrouping between the ages of 9 and 13. Subtraction computation improves from ages 13 to 17, even though little systematic drill is provided in the high school curriculum. Two types of errors were found most frequently: subtraction with some regrouping errors, and reversals--both of which were identified even 50 years ago as two of the most frequent subtraction errors. There is insufficient data to accurately assess whether or not students' ability to subtract is declining. Data do indicate that subtraction performance could be improved. The authors believe that improvement can be brought about by modest efforts of individual teachers if they (a) stress systematic checking of results, (b) organize instruction to develop an understanding of subtraction concepts, and (c) design an instructional program that is responsive to students' needs. (*Baxter & Graeber*)

Carry L. Ray. A critical assessment of published tests for elementary school mathematics. The Arithmetic Teacher, 1974, 21, 14-17.

This article is presented as an aid to elementary school mathematics teachers who use published tests for evaluating student achievement. A short discussion of test characteristics is presented. The advantages and disadvantages of norm-referenced and criterion-referenced is examined. Approximately twenty tests and test batteries are listed. For each test listed the author provides a few descriptive comments that may aid an elementary teacher in choosing or recommending a test. (*L. Callahan*)

Cartwright, G. Phillip. The relationship between sequences of instruction and mental abilities of retarded children. American Educational Research Journal, 1971, 8, 143-150. (ERIC - EJ 036 731)

The relation between sequence of instruction and specific learning abilities 40 EMR adolescents was studied. It was hypothesized that performance of subjects experiencing a systematic instruction sequence would outperform subjects experiencing a scrambled sequence in terms of (a) immediate learning, (b) transfer, (c) retention. An instructional program to teach fractions to normal 5th graders was modified for use with subjects. Results indicated that subjects taking two different sequences obtained equivalent scores on the criterion tests. This study did not provide support for the theory that sequences of instruction should be matched to abilities. *(L. Callahan)*

Caruson, John L. and Resnick, Lauren B. Task structure and transfer in children's learning of double classification skills. Child Development, 1972, 43, 1297-1308.

A double classification task in a matrix format was developed and the structure of the task analyzed according to Gagne's learning hierarchies. An optimal sequence of presentation was developes on the basis of the task analysis, as well as a reverse sequence. Using 26 kindergarten students from an urban school, more optimal sequence subjects learned the tasks than did the reverse sequence subjects-and they learned in fewer trials. The optimal sequence facilitated learning for the group as a whole. However, reverse sequence subjects who managed to learn the difficult tasks then learned the simpler tasks quickly. Results lend support to the power of hierarchical analysis in identifying sequences of learning objectives which can lead to accelerated acquisition of specific cognitive skills. *(L. Callahan)*

Castenada, Alfred; Palermo, David S.; & McCamdless, Boyd R.. Complex learning and performance as a function of anxiety in children and task difficulty. Child Development, 1956, 27, 327-332.

The source of the oft-quoted rule "There is a tendency for the high anxious subjects to perform more poorly in comparison to the low anxious subjects as the difficulty of the task increases". Data on the performance of both adults and fifth graders is reported. *(Grace M. Burton)*

Cathcart, W. George and Liedtke, Werner. Reflectiveness/impulsiveness and mathematics achievement. The Arithmetic Teacher, 1969, 16, 563-567.

Implications of Kagan's research on impulsive/reflective cognitive style was discussed in relation to mathematics learning. It was hypothesized that reflective students would be higher achievers in mathematics than impulsive students since they tend to reflect upon the quality of their answers in contrast to the more unconsidered response of impulsive students. An experiment to test the hypothesis was carried out with approximately sixty second and third graders. The data from the experiment tended to confirm the hypothesis. It was suggested that students who achieve the best in mathematics are those who are more reflective and take longer to consider their responses. *(L. Callahan)*

Cawley, John F. & Goodman, John O. Arithemtic problem solving: A demonstration with the mentally handicapped. Exceptional Children, 1969, 36(2), 83-88.

In line with the thesis that the ultimate goal of an arithmetic program with the mentally handicapped is to facilitate problem solving, the investigators field tested an eighteen week demonstration program. The groups taught by trained personnel (a significant factor) showed significant gains in the two problem solving areas. Gains among retarded and average control groups were not as consistent. *(Kathryn Kemmer)*

Cawley, John F. and Goodman, John O.. Interrelationships among mental abilities, reading, language arts, and arithmetic with the mentally handicapped. Arithmetic Teacher, 1968, 15, 631-636.

The relationships among mental abilities and achievement patterns of mentally handicapped children was investigated. A. PMA test and an achievement test were administered to all children in primary through junior high special classes in one city. Total reading performance showed consist correlation with PMA subtests, with the exception of the special subtest. Verbal and motor abilities were significantly correlated with arithmetic concepts, reasoning, and computation. Relatioships between mental abilities and achievement appeared to be more firmly established with older students than younger. Similar patterns of relationships appeared to exist between arithmetic, and reading/language arts. Implications from the data for arithmetic programming for mentally handicapped children were discussed. *(L. Callahan)*

Cech, Joseph P. The effect of the use of desk calculators on attitude and achievement with low-achieving ninth graders. Mathematics Teacher, 1972, 65, 183-186.

The study examined the effect of calculators on attitude and achievement of ninth graders in general mathematics courses. Experimental and control groups had seven weeks of instruction dealing with addition, subtraction, multiplication, and division of whole numbers. Instruction was guided by previously developed lesson plans to control activities, assignments, and task time. Experimental groups were told to check their work by using the calculators; control groups were merely told to check their work. The data did not support the hypothesis that attitude and achievement of low achievers would be positively effected by the use of calculators.

(L. Callahan)

Chandler, Arnold M. Mathematics and the low achiever. Arithmetic Teacher, 1970, 17, 196-198.

The author of this article served as Director of NCTM's Experiences in Mathematics Ideas (EMI) Project. The article describes some of the conditions of the time that contributed to the motivation of the Project. It also outlines some assumptions and beliefs about learning and instruction that provided the philosophical and psychological framework for the EMI materials designed for low achievers in mathematics. The EMI Project materials were published by NCTM in 1970 and 1971. *(L. Callahan)*

Chase, Clinton I.. Formal analysis as a diagnostic technique in arithmetic. Elementary School Journal, 1961, 61, 282-286.

The efficacy of formal-analysis in solving story problems in arithmetic was

examined in the study. Pairs of sixth grade students matched on mental age and sex, but one a good problempsolver and the other poor, were administered a test of problem-analysis (this instrument reflected the steps in formal-analysis procedures). They were also given a test on arithmetic computations and concepts. The problem-analysis test did not distinguish between good and poor problem-solvers. There were significant differences between good and poor problem-solvers in computation and concepts of arithmetic, however. The evidence from the study indicated that formal-analysis is not a successful means of identifying differences between good and poor problem-solvers. *(L. Callahan)*

Chinn, P.Z. Preparing teachers for individualized teaching of mathematics. Arithmetic Teacher, 1975, 22(5), 422-424.

This article describes how Ms. Chinn sets up her courses on math content and methods of teaching. A basic outline and some description of a semesters activities are given. *(S. Provencher)*

Cleveland, Gerald Arthur & Bosworth, Dorothy L.. A study of certain psychological and sociological characteristics as related to arithmetic achievement. Arithmetic Teacher, 1967. 14, 383-387.

The study examined differences between top-quartile arithmetic achievers and bottom-quarter arithmetic achievers at the sixth-grade level in certain psychological and sociological characteristics. The higher achievers of both sexes and high/low socioeconomic levels attained higher scores in the areas of personal adjustment, social adjustment, and total adjustment. Achievement was generally higher in higher socioeconomic level schools than in lower ones. There were few differences between the sexes in arithmetic achievement or personality factors. Implications of the study for school arithmetic programs were discussed. *(L. Callahan)*

Cobb, Margaret V. The limits set to educational achievement by limited intelligence. Journal of Educational Psychology, 1922, 13, 546-555.

This two-part article examined a large amount of existing data regarding intelligence test performance and progress in high school. The data suggested that there were few high school freshmen who did not have median, or better, intelligence scores. The high school population was limited to approximately the upper half of the whole range of American intelligence. The data further indicated that level of intelligence was highly influencial on continuation in high school. The intelligence test scores were examined for their relation to success in high school subjects. The correlation between algebra and the Army Alpha scores were typically about 0.35. Large geographical differences in intelligence test performance were evident, and educational policy implications were discussed. *(L. Callahan)*

Cohen, Shelby R. The teacher as diagnostician. Education, 1977, 97(4), 351-354.

This article is directed to teachers of all areas and emphasizes the need to consider a varity of factors when setting objectives for students. Take into account the child's background (health, personal, and family). Learn the student's strengths and weaknesses. Find sense modality preferences, like auditory, visual and kinesthetic. The author suggests taking advantage of past records including standarized test results. The need of a pretest to

reveal the different levels of readiness or mastery of concepts is emphasized.

This article mentions that areas in the noncognitive domain (interst, study habits, social adjustment and emotional adjustment) could be informally diagnosed which would also aid in the selection of teaching strategies.

(G. Baur, D. Pigford)

Cohen, Theodore B. Prediction of underachievement in kindergarten children. Archieves of General Psychiatry, 1963, 9(5), 444-450.

This study was concerned with the question of whether it is possible to predict which kindergarten children will have difficulty learning up to IQ potential in first grade. Additionally, predictions of reading and arithmetic difficulties by observation of kindergarten behavior was attempted. The kindergarten teacher, a psychologist, and a child psychiatrist predicted success or failure on the basis of assessments related to their professional training. All raters predicted with quite a high degree of accuracy, but the teacher was the most accurate in predicting which children would learn up to the IQ potential. There was a significant difference between the arithmetic improvement scores of subjects who showed enuretic anxiety versus subjects who did not, favoring those who showed such tendencies.

(L. Callahan)

Connolly, Austin J. Research in mathematics education and the mentally retarded. Arithmetic Teacher, 1973, 20, 491-497.

In the article the author raises some significant questions about teaching mathematics to mentally retarded students. Research studies and authoritative statements were reviewed and their implications used in developing responses to the initial questions. Curricular practices and instructional practices were considered and a teaching paradigm suggested.

(L. Callahan)

Cooke, Dennis H. Diagnostic and remedial treatment in arithmetic. Peabody Journal of Education, 1931, 9, 143-151 and 1932, 10, 167-171.

This two-part article is a report of the techniques used, and results secured, in diagnosing and remedying the difficulties of a small group of fifth-grade pupils. The first part reports in detail on the arithmetic difficulties found in the diagnosis. It also describes the improvement of the fifth graders during the seven-month duration of the remedial period. Some general conclusions were noted, including the fact that individual remedial instruction was more profitable than remedial instruction to a group of pupils. The second part of the article is a brief report of the re tention of improvement of students seven months after the conclusion of the original study.

(L. Callahan)

Cooper, Charles R. and Petrosky, Anthony. Secondary school students' perceptions of math teachers and math classes. Mathematics Teacher, 1976, 69, 226-233.

A summary of a nationwide study of high school students' perceptions of their best, worst and ideal classes. Of the 720 essays, 110 dealt with mathematics classes. Samples of comments from student papers are included in the article. The most relevant factors appeared to be personal traits of the teacher and his or her teaching style. Seven implications based on these comments are drawn.

(Grace M. Burton)

Cox, L. S. Diagnosing and remediating systematic errors in addition and subtraction computations. Arithmetic Teacher, 1975, 22(2), 151-156.

Gives reasons to consider computational skills as necessary. Teachers should find out why students make computational errors. He classifies these types of errors as follows: 1.) Systematic: show a pattern and occur 3/5 of the times used; 2.) Random: found 3/5 of the time, but show no discernable pattern; 3.) Careless: only occur one or two times out of five. Student's computational errors should not be allowed to continue uncorrected he stresses. *(Kay Kemmer)*

Cruickshank, William M. Arithmetic ability of mentally retarded children: I. ability to differentiate extraneous materials from needed arithmetical facts. Journal of Educational Research, 1948, 42, 161-170.

Normal and mentally retarded children of the same mental age (approximately 10.0) were compared with regard to abilities to solve problems. Specifically, problems included extraneous information. Mentally retarded students were significantly inferior in their ability to pick out only the needed information. Language and reading ability here hypothesized as possible reasons. *(Lelon R. Capps)*

Cruickshank, William M. Arithmetic ability of mentally retarded children: II. Understanding arithmetic processes. Journal of Educational Research, 1978, 42, 279-288.

This is a report on an investigation to determine if mentally retarded children of a given mental age are able to understand arithmetic processes as well as normal children of the same mental age. The results show that the mentally retarded children may have greater difficulty understanding problems, especially when they are read to the student orally, than do normal children. Mentally retarded children have more trouble with abstract presentations than with concrete ones. Much of the inferiority of mentally retarded children is due to poor work habits and lack of technical skills. *(Haldon L. Anderson)*

Culea, John. Mathematics, a program for survival. Instructor, 1976, 85, 103-104.

Students are not necessarily remedial that take the Survival Math Program. Most take the regular math plus the survival math. The class meets 2 times each week during the first year. The second year students meet 4 times each week.

The goal is to teach students the math skills needed in everyday life. *(Greg Baur)*

Cunningham, William G. The impact of student-teacher pairings on teacher effectiveness. American Educational Research Journal, 1975, 12, 169-189.

Twelve hundred ninety-one kindergarteners were classified into socio-economic/personality types. Four types encompassed 94.4% of all of the kindergarterners: a) young/advantaged, b) extroverted/black/female, c) introverted/disadvantaged/white/female, d) slow/alienated/male. Most teachers 94.5% also fell into four characteristic sets: a) white/subject oriented, b) black/experienced, c) inexperienced/student centered/empathetic, d) white/experienced/subject centered. Results show that in general a student of one type may do best with a teacher whose characteristics are most closely related to that type, and may do poorer with a teacher whose characteristic are not closely related to the students type. *(Haldon L. Anderson)*

Cunningham, William G. The impact of student-teacher pairings on teacher effectiveness. American Educational Research Journal, 1975, 12, 169-189.

Twelve hundred ninety-one kindergarteners were classified into socio-economic/personality types. Four types encompassed 94.4% of all of the kindergarterners: a) young/advantaged, b) extroverted/black/female, c) introverted/disadvantaged/white/female, d) slow/alienated/male. Most teachers 94.5% also fell into four characteristic sets: a) white/subject oriented, b) black/experienced, c) inexperienced/student centered/empathetic, d) white/experienced/subject centered. Results show that in general a student of one type may do best with a teacher whose characteristics are most closely related to that type, and may do poorer with a teacher whose characteristic are not closely related to the students type. *(Haldon L. Anderson)*

Dahlke, Richard M. Studying the individual in an individualized course in arithemtic at a community college: A report on four case studies. Mathematics Teacher, 1975, 68, 181-189.

This article examines the deficiencies of an individualized, self-paced course in arithmetic at the community college level. Four case--studies are presented of students who did not complete the course in one semester. Reasons for their failure to reach completion are examined and recommendations for course improvement are made. It is recommended that one of the main objectives of the instructor of such a course be to improve students' attitude toward mathematics. The use of visual and manipulative aids is recommended for slower students, and that a development very similar to that used in the elementary curriculum should be provided for those students who can't handle the normal classroom material.

(Haldon L. Anderson)

Dahmus, M.E. How to teach verbal problems. School Science and Mathematics, 1970, 70(2), 121-138.

This article gives a detailed description of the DPPC method of problem solving. This method is the result of twenty-five years of study based on the premise that causes of student difficulties lie not in the pupil but in the teaching. The letters DPPC stand for "direct, pure, piecemeal, and complete." This method allows the student to translate English expressions to mathematical symbols, to solve equations, and to solve systems of equations. It requires students to use paper and pencil for every step of the equation; it does not ask them to mentally work several steps and then show the final stage in written form. This method was especially devised for the lower ninety percent in mathematics.

(S. Provencher)

D'Augustine, Charles H. Multiple methods of teaching operations. The Arithmetic Teacher, 1969, 16, 259-262.

This article presents a sample of different methods for teaching each of the four basic operations on whole numbers. Examples of the use of stories, manipulatives, and visuals are given for addition and subtraction. Geometric models, patterns, analysis, and generalizations are discussed as methods of presenting multiplication. the use of families of facts in illustrated as a method of relating facts in order to make learning easier.

(Haldon L. Anderson)

Davis, Edward J. Two teachers for a basic or remedial science or mathematics class - is it really outlandish? School Science and Mathematics, 1976, 76(6), 466-468.

Mr. Davis feels that even with many new materials added to the curriculum, teachers of basic and remedial classes are not experiencing the success they would like. He thinks two teachers per room (in some cases combining two classes into one with two teachers) would work more effectively.

His article is basically divided into two sections: "A Case For Two Teachers" and "How Can It Be Arranged?" *(G. Baur, D. Pigford)*

Denney, Nancy W. A developmental study of free classification in children, Child Development, 1972, 43, 221-232.

This study concerns replications of similar studied by Vygotsky and by Inhelder and Piaget. Children, ages 2 to 16, were asked to group or classify wooden blocks. Half of the subjects used free-grouping (do it anyway you want) and half used a verbal labeling procedure. Neither the results of Vygotsky nor those of Inhelder and Piaget were replicated. *(Paul D. Scott)*

Devault, M. Vere. Math in plain English. Education Digest, March, 1976, 36-38.

This article stressed that teachers should state specific objectives at the beginning of the year and use these as guidelines to plan for groups and individuals. In this way, you would diagnose specific problems and group for remediation purposes.

It also mentioned the importance of using everyday situations and real objects to make math meaningful and motivating for students.

(G. Baur, D. Pigford)

Denman, Theresa. Yes, he can add. Instructor, 1974, 83, 28.

Three questions are raised and answered.

(1) "What guidelines should be considered when developing a program for junior high students who are weak in the fundamental operations of arithmetic?" (2) "Should the metric system be taught to fourth and fifth graders?" The metric system should be introduced to all students at all levels. Presented are some concepts which should be emphasized when teaching the metric system. (3) "What should be considered when setting up a mathematics learning center in an open classroom?"

(Frances Kelly)

Dickson, Judy T. The plight of a child. The Arithmetic Teacher, 1968, 15, 19-22.

This article deals with a third grader's inability to understand place value. The problem first arises in addition with re-grouping and proceeds to subtraction with regrouping. Counting sticks were first employed but not successfully. Not until the student was using a bean chart and could actually see that 4 beans could not be taken from one bean did progress begin. This student did not understand place value in primary grades, so she cannot build it. The author recommends that school text books be standardized and that more emphasis be placed on numeration.

(Janet Green)

Dienes, Zoltan P. Some basic processes involved in mathematics learning. Research in Mathematics Education. Washington, D.C., National Council of Teachers of Mathematics, 1967.

Mathematical play should be regarded as an integral part of the learning

cycle, since from this play children abstract, generalize, and particularize mathematical relationships. Until recently it was thought that the only way to learn mathematics was through symbolism. However, there are indications that a high degree of abstraction is necessary before symbolism can be used effectively. If symbolism is introduced after only one embodiment, then when questioned children will invariable go back and manipulate rather than use the symbolism. Children seem to relate to symbolism better if they have had a hand in its development.

(*Haldon L. Anderson*)

Dodd, Carol A., Jones, Graham A., & Lamb, Charles E., Diagnosis and remediation of pupil errors: An exploratory study. School Science and Mathematics, 1975, 75(3), 270-276.

The three authors undertook this study at Indiana University during the school year of 1972-73. They wanted to "compare the effectiveness of two different programs of instruction in preparing preservice elementary teachers to identify error patterns and to prescribe remediation for errors occuring in elementary mathematics." They compared a regular math methods course with a math methods project course associated with the National Science Foundation. The project course integrated math content and methods in a laboratory type setting. The project course offered opportunities to observe and become involved in the elementary classroom. Students were also trained to identify error patterns and to prescribe remediation for students. (*G. Baur, D. Pigford*)

Doggett, M. Aiding the seriously deficient learner in computation. The Mathematics Teacher, 1978, 71 (6), 488-493.

Belmont Junior High School planned, implemented, and evaluated a computation learning lab to help students who lacked basic understanding of mathematics fundamentals. The author describes the lab in operation, the motivational strategies used, and the actual achievement gains demonstrated by the students. (*Linda Zimmerman*)

Donady, Bonnie & Tobias, Sheila. Math anxiety. Teacher, 1977, 95(11), 71-74.

(See also Education Digest, 43 (Dec. 1977): 49-52). Feelings and attitudes toward mathematics were studied at Wesleyan University Math Clinic, Middletown, Conn. Math anxiety termed as "nonrational distaste for and avoidance of math." Research shows a direct relation to females--thus, affecting girl students and great number of teachers. The myth that more boys like math is discarded. Traditional sexist roles in society affect math attitudes. Teacher assumptions tend to support this. Programs to attack math avoidance discussed. Practical suggestions for teachers are given: allow use of certain crutches; encourage retesting; provide spatial relation game skills. (*Graeber and Baxter*)

Drasgow, James. Underachievers. Journal of Counseling Psychology, 1937, 4(3), 210-211.

This article begins with a review of the work done by Barbara Kirk in the area of underachievement. The conclusions the author makes are based on his study of a dozen underachieving college students.

The author postulates that the role of a counselor may be to help the underachieving client divorce himself from an alien curriculum and discover an appropriate one. He further states that the client's acceptance

of factors suggests a favorablee program and seems to expedite counseling. (*Martha S. Gage*)

Dreger, Ralph-Mason & Aiken, Lewis R. Jr. The identification of number anxiety in a college population. Journal of Educational Psychology, 1958, 48, 344-351.

Number anxiety was found to be unrelated to general intelligence but related to achievement as measured by final course grades in mathematics. Number anxiety was found to be different from general anxiety in this study, one of the earliest to investigate the emotional aspects of mathematics education. (*Grace M. Burton*)

Dougherty, Florence. The Akron experiment. The Arithmetic Teacher, 1962, 9, 446-448.

A discussion of a program to emphasize computational skills is discussed. Strategies and materials used are described. Conclusions center not on the progress made but rather on opinion. Eg., Students need more practice to make responses automatic; teachers need to itemize and analyze class weaknesses and proceed accordingly, etc. Some worthwhile ideas are presented but no objective evidence is cited. (*Lelon R. Capps*)

Dunkley, M.E. Mathematics and the disadvantaged. Elementary School Journal, 1972, 73, 44-49.

This article is a report of the Special Curriculum Project, sponsored by the School Mathematics Study Group, that attempted to develop materials for a mathematics program for culturally deprived children in elementary schools. Two groups of children were used. The experimental group came from deprived areas and received materials and help from consultants. The control group was made up of children from middle class areas and disadvantaged areas. The control group received no materials or special help. An inventory of skills was developed and used as a pretest, posttest and on a mid-year assessment. The results indicate that pupils from deprived backgrounds are not initially prepared to move at the same pace as middle-class children in learning method and many have not reached the same level of cognitive development. A more detailed discussion of the results is included in the article. (*Martha S. Gage*)

Dutton, Wilbur H. Attitudes of prospective teachers toward arithmetic. The Elementary School Journal, 1951, 52, 84-90.

A very early study of the attitudes of future teachers towards mathematics. The results were similar to those currently reported: the major reason for student dislike of the subject was poor teaching. In light of the fact that this article was printed over 25 years ago, the suggestions for future research make interesting reading. (*Grace M. Burton*)

Edwards, R. Phillip, Alley, Gordon R. & Snider, Bill. Academic Achievement and minimal brain dysfunction in mentally retarded children. Exceptional Children, 1971, 37, 539-540.

Subjects with minimal brain dysfunction (MBD) were listed on academic achievement tests for mentally retarded. Subjects were classified into four groups: a) neurological and visual-motor impairment, b) visual motor impairment only, c) neurological impairment only, d) neither visual-motor or neurological impairment. Groups were compared using tests for unrelated samples.

Subjects with neurological impairments only were superior to subjects with visual-motor impairments only and also were superior to subjects with visual-motor and neurological impairments.

Conclusions are that arithmetic achievement in MR children is related to visual-motor impairment. (*Lelon R. Capps*)

Epstein, Marion G. Testing in mathematics, why? what? how? The Arithmetic Teacher, 1968, 15, 311-319.

The distinction between tests, measurement and evaluation is discussed. How to construct a classroom test is covered with specific attention to an example in mathematics. Most importantly, many pitfails of test construction and writing are discussed. A helpful article to teachers wanting to construct quality classroom tests. (*Lelon R. Capps*)

Erickson, Leland H. Color as an aid in teaching concepts. The Arithmetic Teacher, 1958, 5(1), 10-14.

The author believes that the use of color can positively affect a child's understanding of basic operations. Color can be used to distinguish place value or could distinguish a numerator and a denominator in common fractions. The author does note that color should be used for remediation and should be discontinued when no longer necessary for the child's understanding of concepts. (*Mary Ann Rossi*)

Evans, Roy. Remedial cases in arithmetic, case 2. Peabody Journal of Education, 1930, 7, 208-217.

The Buswell-John was used to diagnose the subjects specific problems in fundamental operations of arithmetic. Specific remediation was planned and completed based on the diagnosis. It was concluded based on a post evaluation that the student had progressed in many specific arithmetic skills. The importance of individual attention and instruction was noted. (*Lelon R. Capps*)

Farnham-Diggory, S. On readiness and remedy in mathematics instruction. The Arithmetic Teacher, 12, 614-621.

The author first relates how the brain is affected by outside impulses and how necessary it is for the visual stimuli to be connected to the nural cell for comprehension to happen. And unless we have developed coordination between mathematical symbols and information contained in other parts of the brain, we are not comprehending mathematics. Piaget's conservation of numbers is used as an example for showing readiness. Strong recommendation is made for materials to provide visual and action based mathematical experiences for all children. (*Richard Weinsier*)

Feinstein, Irwin K. Preparation for effective mathematics teaching in the inner city. The Mathematics Teacher, 1972, 65, 79-85.

This article concerns the mathematics teachers in inner city schools. Suggestions are given for learning strategies that could be utilized by a math teacher in such a setting.

Three qualities that the math teacher in the inner city school should possess are discussed. The first is that the teacher must have infinite patience and perseverance. The second quality is the ability to communicate. The third quality is that the teachers must have knowledge of learning theory as it applies to mathematics. The author makes several recommendations including the creation of text material that will be

suitable for inner-city teachers, institution of experimental projects to develop good pre-service in-service programs, and utilization of leaders in the field to serve as resource persons to inner-city districts.

(*Martha S. Gage*)

Feldhusen, John F., Denny, Terry & Condon, Charles F., Anxiety, divergent thinking and achievement. Journal of Educational Psychology, 1965, 56, 40-45.

On the basis of a sample of 273 seventh and eighth grade students. Different correlational patterns were found for boys and girls. Performance on STEP and SCAT tests was significantly and negatively related to general anxiety level. Originality and creativity were not significantly related to general anxiety level. (*Grace M. Burton*)

Felton, Sandra, A multiplication process. Academic Therapy, 1974, 9(3), 249-51.

This article dealt with a way to teach multiplication to perceptually impaired children. The article stated the fact that the old way was confusing to children of this impairment. It stated a technique which could eliminate many difficulties. It requires no regrouping and no shifting of processes. Through short drills the child learns only to write the answer and the number of zeros in the problem. The article continues to explain the technique and give examples of how it works. It also stated how children of constant failure in multiplication experience understanding, relief, and accuracy the first time they saw it. (*Janet M. Baldwin*)

Fennell, Francis & Trueblood, Cecil R., The elementary school as a training laboratory and its effect on low-achieving sixth graders. Journal for Research in Mathematics Education, 1977, 8(2), 97-106.

The focus of this report was to present formative data to show the impact that two field-based teacher-training experiences had on low-achieving sixth-grade pupils. The first experience was designed to train prospective elementary mathematics teachers to perform the professional tasks needed to implement the steps of the Goal-Referenced Instructional Model (Trueblood, 1971) for one type of individualized instruction. The second experience trained prospective elementary teachers to implement the procedures set forth in the teacher's guide for the classroom text of a school district. Findings report that both groups of teachers significantly increased their pupils' unit mastery test scores without negatively affecting their attitude toward elementary school mathematics.

Fennema, Elizabeth H. Models and mathematics. Arithmetic Teacher, 1972, 19, 635-640.

Many elementary Mathematical concepts can be represented by two types of models, concrete and symbolic. Concrete models utilize three-dimensional objects while symbolic models incorporate mathematical numerals and signs.

The results of studies conducted to ascertain whether a significant learning difference favored teaching supplemented by the use of concrete models as opposed to traditional teaching indicated that children in the first, third, and fourth grades benefited from the use of concrete materials but that children in the fifth, sixth, and eighth grades were unaffected.

(*Martha Moye*)

Fennema, Elizabeth H. The relative effectiveness of a symbolic and a concrete model in learning a selected mathematical principle. Journal for Research in Mathematics Education, 1972, 3, 223-238.

The purpose of the study was to determine if there was learning differences in the groups of children who learned a particular mathematical principle represented by a concrete or a symbolic model. The subjects were 95 seven and eight year olds who were randomly assigned to one of eight groups, four of which used a concrete model and the other four a symbolic model. The same teacher instructed both groups for 14 sessions. Multiplication defined as the union of two disjoint sets was the selected mathematical topic. Cuisinarie rods were used for the concrete model and repeated addition for the symbolic.

An ANOVA was used to interpret the data. Recall test results indicated that children could learn a mathematical idea by either model. The symbolic model was preferred to the concrete for transfer or extension of the principle. (*Martha Moye*)

Fey, James T. Classroom teaching of mathematics. Review of Educational Research, 1969, 39, 535-551.

The purpose of Fey's article was to provide a review of the research in Mathematics education reproted from 1964 through 1968 that dealt with the personal characteristics of teachers and teacher classroom behavior. (*Martha Moye*)

Fincher, Glen E. & Fillmer, H. J. Programmed instruction in elementary arithmetic. The Arithmetic Teacher, 1965, 12, 19-23

The authors conducted a study to compare the achievements in the addition and subtraction of fractions of a group using programmed materials with a group using a conventional classroom approach. The experimental and control groups consisting of a total of 309 fifth-grade students. the groups received instruction for 45 minutes per day for four weeks. Results indicated that the programmed textbook was more effective than the conventional classroom based on posttest results, and as effective in the retention of knowledge. (*Martha Moye*)

Finley, Carmen J. Arithmetic achievement in mentally retarded children: The effects of presenting the problem in different contents. American Journal of Mental Deficiencies, 1962, 67, 281-286.

The study investigated what affects the nature of the question asked have on the results obtained. The instruments used are a concrete test, a pictoral test, and a symbolic test. Significant affects were found for both normal and retarded students. (*Paul D. Scott*)

Fishbein, Harold D., et. al. Children's understanding of spatial relations: Coordination of perspectives. Developmental Psychology, 1972, 7, 21-33.

This article concerns experiments performed with young children ages 3 to 9 years. The experiments involved the matching of photographs with given views of a toy, and vice versa. The theoretical framework for the design of the study stemed from the psychology of Herbert Spencer. (*Paul D. Scott*)

Foti, Francis T. Teaching the mentally handicapped. The Arithmetic Teacher, 1959, 6(3), 156-158.

This is a brief summary on what to teach the mentally handicapped in mathematics. An arithmetic program should include socially significant

situations and include a direct and systematic approach in the program of instruction with a minimum dependence on transfer of training for learning new skills. Methods should be determined by specific disabilities or abilities of the mentally handicapped students. *(T. Bauman)*

Fremont, Herbert, Diagnosis: An active approach. The Mathematics Teacher, 1975, 68(4), 323-326.

This article gives justification for the diagnostic method of teaching. "Through diagnosis the teacher is able to gear the work to the student, rather than fitting the student to the work - in lockstep with all other students, whether he knows the mathematics or not and whether he understands the concepts or not."

The author feels that using tests to diagnose weaknesses "may well be offering the kind of failure experience that will only result in further disappointment". Suggests that action designed activities be used as a diagnostic means to generate student interest. *(G. Baur, D. Pigford)*

Fuller, J. A program of diagnostic testing and remedial treatment in arithmetic. Mathematics Teacher, 1946, 39(8), 380-384.

The author discusses the need for, the meaning of and the techniques of educational diagnosis. Criteria for choosing diagnostic test material is listed. The article continues on the discuss the remedial program and states that "remedial work should be required of pupils whose achievement is below the level of their ability and elective for those who desire it." Evaluation standards and the practicability of the programs are discussed. *(S. Provencher)*

Gemignani, Michael C. Remedial mathematics: An administrator's viewpoint. American Mathematical Monthly, 1977, 84, 481-484.

Discussion of increase of college students needing remediation program in math. Because of effectiveness and limited fundings author recommends funds should go to regular college level courses for the most return. It is discussed that to allow remediation to a student who won't be able to do college level work and thus fail eventually or who should not be in college in the first place is a deceptive practice.

Glavin, J.P. & Annesley, F.R. Reading and arithmetic correlates of conduct problem and withdrawn children. The Journal of Special Education, 1971, 5(3), 213-219.

This article describes a study of the academic achievement of behavior problem children as a whole group and focuses on the two major categories--conduct problem and withdrawn children. Additional objectives explored achievement levels in reading and arithmetic, differences in reading and arithmetic total scores and concrete versus cognitive types of skill proficiencies. The study is described; the procedures explained; the results tallied on charts and a final discussion follows on the implications of the findings. *(S. Provencher)*

Gough, Sister Mary Fides. Mathemaphobia: Causes and treatments. Clearing House, 1954, 28, 290-294.

Twenty-five years ago the author asked, "Why not a foundation like the heart and cancer foundations to study the causes and cures of mathemaphobia?" Is the mental balance and stability of students of less importance than their physical well-being?" In the absence of such a foundation, she

lists causes and suggests remedies that could have been written yesterday or tomorrow. A clear and comprehensive treatment of this subject, illustrated with examples from the author's quarter-century in the classroom. *(Grace M. Burton)*

Green, R.A. A color-coded method of teaching basic concepts and procedures. Arithmetic Teacher, 1970, 17(3), 231-233.

This article describes a method for color-coding in order to teach the basic operations. Conventional methods (abacus, rods, etc.) proved fruitless. The initial step was to develop an understanding of value equivalency using money, i.e. ten pennies equal one dime, ten dimes equal one dollar. The equivalencies were color-coded -- brown, silver, and green -- representing the place values of ones, tens, and hundreds. *(S. Provencher)*

Gregory, Mary K. Sex bias in school referrals. Journal of School Psychology, 1977, 15, 5-8.

One hundred and forty teachers (grades K-6) were asked to state the likelihood of referral for children in five behavioral anecdotes. For help in reading, personality prolems and arithmetic, teachers were more likely to refer boys than girls with identical problems. In all cases but reading, the difference was significant. A girl described as one who "cannot grasp arithmetic concepts at all" had only a 50-50 chance of being referred. Only 62.1% of the teachers would refer a boy with that problem. There was no limit to the number of children a teacher could refer. *(Grace M. Burton)*

Griggs, Shirley A., An experimental program for corrective mathematics in schools for the socially malajusted and emotionally disturbed. School Science and Mathematics, 1976, 76(5), 377-380.

This program utilized the mathematics laboratory approach in teaching boys from New York City schools for emotionally disturbed and socially malajusted. The program was designed to improve the math skills of students two grade levels behind (as measured by the Metropolitan Aptitude Test). The program used individual and small group instruction and math laboratory materials such as manipulative materials, learning packets and simulation games.

The results of this study seem to suggest that using the mathematics laboratory approach and the instruction given on a one-to-one basis proved successful for this group of boys with social-emotional problems.

(G. Baur, D. Pigford)

Hamilton, Andrew, Getting back in the game. American Education, 1976, 12, 20-23.

Children in the Newport Mesa, California School System are enrolled in Project Cath-up. This children are those who have fallen behind in reading or math. It is not a remedial program, but bright studentd who have fallen behine are enrolled. The program is filling in blank areas of a students early education experience. *(G. Baur, D. Pigford)*

Hargis, Charles H. Significance of the grammar of one-to-one correspondence in teaching counting to the retarded. Education and Training of the Mentally Retarded, 1971, 6(4), 170-171.

The author explains that language or communication is the root of all learning. All learning is communicated on a one-to-one correspondence and therefore the ability to communicate corresponds with the ability to learn.

Children learn to associate words such as a, one of, each one of, as notions of oneness. A retarded child lacks the ability to communicate and also lacks the basic association of grammar to arithmetic. Thus, the inability to communicate is the primary problem in teaching arithmetic to the retarded. (*Mary Ann Rossi*)

Heddens, James W. & Hynes, M. Division of fractional numbers. The Arithmetic Teacher, 1969, 16(6), 99-103.

The authors in this article are dividing fractional numbers assuming that the best learning is accomplished when the process is meaningful to and understood by the learner. This guide led to the use of sets, regions, number lines, and comparing with whole number division to help the learner. Generally the method used was to mark off or show how much was available (dividend) and to then separate it into assigned groups (divisor). The number of groups marked off is the answer (quotient) the learner is striving to achieve through the reasoning process.

(*Richard Weinsier*)

Higgins, Jon L. A new look at heuristic teaching. The Mathematics Teacher, 64, 487-495.

The author looks at the heuristic or logical approach to solving math problems. Much of the article is based on George Polya's "How to Solve It". Mr. Higgins suggests a "let's see if we can solve" approach rather than "guess what I'm thinking". He also feels that asking questions at every level and stage helps the student learn for himself. Guessing, comparing, looking for different methods, checking, and asking why are all a part of the heuristic teaching approach. (*Richard Weinsier*)

Hill, Kennedy T. & Eaton, Waren O. The interaction of test anxiety and success-failure experiences in determining children's arithmetic performance. Developmental Psychology, 1977, 13, 205-211.

Sixty fifth and sixth grade children were given addition problems under two conditions: 2/3 success and 1/3 failure, and success-only. The performance of high-anxious children was inferior on the 1/3 failure condition in response rate, cheating and errors made to their performance in the success-only task. There was little change in any measure for the low-anxious children. (*Grace M. Burton*)

Hoel, L. What constitutes remedial work in arithmetic. Mathematics Teacher, 1950, 48(1), 19-24.

The three phases of remedial work are considered -- isolated cases, arithmetic epidemics and long range basic research and study. Nine discoveries such as low IQ, short memory and attention span relating to the causes in isolated cases are listed and discussed. General suggestions for correction are given. Factors responsible for group difficulty are described. (These all seemed to be the result of poor teaching.) The long range program or the prevention program is discussed. (*S. Provencher*)

Hopkins, Martha H. The diagnosis of learning styles in arithmetic. Arithmetic Teacher, 1978, 25(7), 47-50.

Discusses diagnosis as it applies to individual instruction in arithmetic at the elementary level. Tests and batteries cannot alone determine planning. Other considerations listed. Sequential step of learning math process stressed for testing. Child's own effective learning style must be identified and used. (*Graeber and Baxter*)

Howell, D. Project SOSO [Save our slow ones]. The Arithmetic Teacher, 1972, 19(5), 29-33.

The article tells of a project in Mississippi to help elementary teachers who are teaching low achieving students in 6th grade. The purpose was to develop a program using many manipulative devices to teach whole number operations, fractions, number theory, geometry, and probability. Students were pulled from class twice a week for 45 minutes of instruction. No testing was done. Very favorable responses were found from students and teachers. *(Richard Weinsier)*

Hutchings, Barton. Low-stress subtraction. The Arithmetic Teacher, 1975, 22(3), 226-232.

A description of an algorithm for subtracting whole numbers that has been used successfully of the author, collegues, and students with different types of students. Low-stress algorithms have two mechanical characteristics: every step is notated and there is no alternating between different kinds of steps. Using Hutching's algorithm means an explicit, uninterrupted expression of renamed minuends by easily perceived numerals. Bibiography includes 13 other articles by the same author dealing with low-stress algorithms (+ and -). *(Kathryn Kemmer)*

Johnson, James O., Maertens, Norbert W. & Schooley, Daniel E. When to correct arithmetic problems - critical variable. School Science and Mathematics, 1969, 69, 799-805.

Three fourth grade arithmetic classes were used to determine whether providing knowledge of results (KR) after each response on an arithmetic exercise would result in performance different from that obtained when KR is provided following completion of the exercise. Results indicated that those receiving immediate knowledge of results performed significantly higher than those receiving delayed knowledge of results. It was suggested that further research concerning the interaction of age with KR as well as attitude and motivation need to be carried out. *(Douglas Edge)*

Johnson, Mauritz & Scriven, Eldon. Class size and achievement gains in seventh- and eighth-grade English and mathematics. The School Review, 1967, 75(3), 300-309.

In 1957-58 and 1958-59, some 70,000 New York State seventh- and eighth-grade pupils in approximately a hundred representative school systems were tested with the Iowa Basic Skills battery. 130 English classes and 135 mathematics classes were available for study, 103 in grade 7 and 162 in grade 8. Cutting points were used to classify class sections on initial achievement level, variability, and size. The mean gain over the one year period was computed. The results indicated that the gain differences between large and small classes are generally very small and inconsistent. *(Douglas Edge)*

Kurtz, V. Ray. Kindergarten mathematics--a survey. Arithmetic Teacher, 1978, 25(8), 51-53.

Attempts to look at what competencies in math are achieved by kindergarten children and what trends are in practice today. Counting, numeral recognition, set identity, writing numerals, shape recognition given as clear competencies. Two charts present questionable competencies for this level. A survey of methods used show 75% schools have adopted series

and 53% teach some math daily. Of 100 teachers, 21 feel their program is inadequate.

Kurtz, Ray and Spiker, Joan. Slow or learning disabled--is there a difference? Arithmetic Teacher, 1976, 23(3), 617-622.

Through abilities testing profiles the learning characteristics of L.D. students are compared to slow learners. S.L. students have a 80-90 I.Q., not so with average or better I.Q.'s of L.D. Procedures to help math instruction discussed: implications to number learning and spatial and visual perceptions.

Lankford, Francis G., Jr. What can a teacher learn about a pupil's thinking through oral interviews? The Arithmetic Teacher, 1974, 21(4), 26-32.

A summary of the author's earlier study, Some Computational Strategies of Seventh Grade Pupils, Final Report, U.S. Department of Health, Education, and Welfare, 1972. See file #5. *(A. Graeber and Baxter)*

Lazarus, Mitchell. Mathophia: Some personal speculations. National Elementary Principal, 1974, 53, 16-22.

An introductory article on the condition which might be recommended to administrators. Distinction is made between mathophia and discalculia.

(Grace M. Burton)

Lazarus, Mitchell, Rx for mathophobia, Education Digest, 1975, 41, 7-10.

Parents, students, and even teachers are affected by Mathophobia. New math tried to help by showing why arithmetic results come out as they do. It confused many people instead. The new approach is professional mathematics where it uses real problems and real solutions. The new math is necessary to provide a strong foundation for more advanced work.

(G. Baur and D. Pigford)

Lazarus, Mitchell. RX for mathophobia. Saturday Review, 1975, 2(June, 28), 46-48.

A popular treatment of math anxiety. RX: use reality-based teaching and applications of mathematics to the real world. *(Grace M. Burton)*

Lazerick, Beth E. & Harris, Carolyn K. Don't give up yet. Arithmetic Teacher, 1979, 26(3), 42-43.

Eight remedial techniques are presented for eight specific difficulties that children have in mathematics. Concrete and pictorial suggestions are offered.

Lerner, Sandra. Aspects of teaching long division to a group of exceptional children. Journal of Learning Disabilities, 1973, 6(6), 151-154.

A new approach - the Aspect Method - to teach long division, based on a theoretical model of how the brain functions in problem-solving, was presented to a group of mentally ill adolescents who were previously unable to learn long division when it was presented using traditional teaching techniques and programmed instructional methods. Subjects with an I.Q. score one S.D. below normal and with an adequately developed number sense, mastered the tasks. The subjects who failed the test (2) had I.Q. scores below 76 and their performance on a cognitive test using Piagetian protocols indicated they were working on a preoperational level of thinking. *(Kathryn Kemmer)*

Luke, Hope & Trembley, Phil. A model for a remedial mathematics program, The Arithmetic Teacher, 1977, 24(2), 140-144.

This article describes a model mathematics program in the Clarkstown School District of New City, New York. It is called Math Control Central (MCC). The organization of the MCC is given. The MCC has as its overall objective "all students in the program show a significant increase in their skill in mathematical functioning as measured by three achievement tests." The tests and more specific objectives are given in this article. The rationale for such a program and an example of instructional method are given. *(G. Baur, D. Pigford)*

Mayhall, William F. & Jenkins, Joseph R. Scheduling daily instruction: Implications for resource programs. Journal of Learning Disabilities, 1977, 10, 159-163.

Two experiments in reading and arithmetic were conducted on the effects of varying frequent instruction (daily vs. twice weekly). Total teaching time was equivalent. The math section involved 16 second grade children and learning addition facts. A two week period of time was used. Frequency of instruction may influence acquisition of basic skills. Daily instruction segments superior to non-daily segments. Use of teacher aides can insure daily delivery of resource teacher not available on daily basis. Organization for resource program suggested.

McMillan, James H. Factors affecting the development of pupil attitudes toward school subjects. Psychology in the Schools, 1976, 13, 322-325.

Report of a survey of 124 abstracts of dissertations written between 1969 and 1975. Teacher attitudes and enthusiasm toward the subject and student related variables such as self-concept, previous attitude, parental attitude may have more impact on attitudes formation than instructional variables, McMillan states. *(Grace M. Burton)*

Melton, Joseph, Hints for mathematics tutors. The Arithmetic Teacher, 1976, 23(5), 380-381.

When this article was written, Professor Melton was in charge of a math tutoring program at San Diego State University similar to the Math Clinic at Indiana University of South Bend. The article tells of some of the advice he gives his students in regards to dealing with establishing rapport, diagnosis, and remedial sessions. *(G. Baur, D. Pigford)*

Mickelsor, John M. What does research say about the effect of the core curriculum? School Review, 1957, 65, 144-160.

Defining core curriculum as the combining of two or more subjects that would usually be taught separately, the author gives a review of the related literature, using this as a basis for determining whether or not a program was a core program. Much of the research, based on standardized scores, tends to favor the core programs. *(Janet K. Scheer)*

Minde, K., Lewin, D., Weiss, Gabrielle, Lavigueur, H., Doublas, Virginia & Syles, Elizabeth. The hyperactive child in elementary school: A 5 year, controlled, followup. Exceptional Children, 1971, 38, 215-221.

Thirty-seven children diagnosed as hyperactive 4-6 years previously are compared with thirty-seven nonhyperactive classmates. Results indicate that hyperactive children are rated by their teachers as displaying far more behavioral problems than the nonhyperactive children. They also

have a significantly higher failure rate in all academic subjects. This study rules out intelligence as the main contributor even though the hyperactive students displayed an increase in learning disorders and did poorer as a group on IQ testing. (*Janet K. Scheer*)

Mitzman, Barry. Seeking a cure for 'Mathephobia'. American Education, 1977, 13, 11-14.

A report of the methods used by the Oregon System in Mathematics Education (OSME) program. This NSF-funded venture sought to dispell the uneasiness of teachers concerning mathematics and expand teachers' perception of mathematics through the use of peer-taught workshops. Techniques which might be implicated in other workshop settings are explained. The use of "circuit rider" consultants is also described. (*Grace M. Burton*)

Monk, Janice J. & Stallings, William. Effects of item order on test scores. Journal of Educational Research, 1970, 63(10), 463-465.

Pairs of tests using the different ordering of the same items were given to Georgraphy 101 students. These tests were primarily power tests. The results tended to support the idea that rearranging test items will create equivalent tests when the item difficulty ordering is non-systematic and the test is a power test. (*Janet K. Scheer*)

Monroe, Walter S. A series of diagnostic tests in arithmetic. Elementary School Journal, 1919, 19, 585-609.

The author includes a series of 21 tests representing 61 types of examples, requiring 31 minutes to take. He gave the test to 300-450 children in each grade in several cities in mid-year to measure accuracy and rate. His conclusions were that not only did pupils of a group differ widely in ability but also each pupil possessed each group of abilities in widely differing degrees. His tests are of value to teachers, first, as a statement of the important types of examples, and secondly, as an instrument of diagnostic measure. (*T. Bauman*)

Moore, Edwina, & Platte, DeGroff. Diagnosing pupil needs in arithmetic. The Arithmetic Teacher, 1959, 6(1), 33-35.

This article deals with the methods which were used by a group of California arithmetic teachers to build their own diagnostic test. This course was decided upon after their failure to find a standardized test which would give them the information they wanted. It lists the areas of arithmetic which were tested, the criteria by which each test item was measured, and an analysis of test results. Teachers found that constructing this diagnostic test helped them gain additional insight into the process of arithmetic and learning. (*Linda Zimmerman*)

Moore, Ruth C. & Ogletree, Earl J. A comparison of the readiness and intelligence of first grade children with and without a full year of head state training. Education, 1973, 93, 266-270.

First grade children from an inner city school system with Head Start training were compared with non-Head Start children from the same school system for development of readiness and IQ performance. The Head Start group scored significantly higher on both the readiness and IQ performance tests. (*Janet K. Scheer*)

Morris, Larry W., Kellaway, Dale S. & Smith, Donna H. Mathematics anxiety rating scale: Predicting anxiety experiences and academic performance in two groups of students. Journal of Educational Psychology, 1978, 70, 589-594

The Mathematics Anxiety Rating Scale (MARS) was administered to 52 psychology and 54 mathematics students at the college level. The psychology students had higher MARS scores but there was no sex difference in MARS scores in either group. For both groups, MARS was a valid predictor of test anxiety; a strong inverse relationship between worry and achievement was found. *(Grace M. Burton)*

Morton, R.L. An analysis of pupils' errors in fractions. Journal of Educational Research, 1924, 9, 117-125.

Diagnostic tests with fraction problems in all four operations were given to eighth grade students. Causes of errors were determined and categorized. Over 90 percent of the errors could be detected and attributed to a specific cause. *(Janet K. Scheer)*

Morton, R. L. The review versus the telescoped reteaching of the work of preceding grades. Arithmetic Teacher, 1946, 39(5), 225-228.

Because learning is often partial and incomplete, the "beginning of the year" review is often inadequate. The reasons are stated in this article and the "telescoped" (briefer, less detailed) reteaching method is advocated. Coupled with diagnostic tests and drill this method proposes to supercede the pitfalls found in conventional review methods. *(S. Provencher)*

Moskowitz, Irving. 3R's + relevance = real cool summer school. School Shop, 1970, 30, 76-78.

A project that combined the action and involvement of practical occupational training with the academic necessities of English and mathematics was offered, as an alternative to traditional summer school, to high school boys who had failed English and math. Success of the project was attributed to student involvement, physically active learning, flexible structure, teacher involvement, and presentation of learning material in a meaningful context. *(Janet K. Scheer)*

Murphy, Lois B. Foundations for good beginnings. Young Children, 1969, 25, 5-11.

Head Start is too late. Many children enter nursery school with emotional or physical handicaps that have already retarded their readiness for learning. The author discusses the need for teachers and parents of 2 and 3 year olds to work together to detect and arrest these deficiencies. Ideas for implementation of this idea are also provided in the article. *(Janet K. Scheer)*

Muscio, Robert D. Factors related to quantitative understanding in the sixth grade. The Arithmetic Teacher, 1962, 9, 258-262.

Sixth-graders were investigated to determine the relationships between quantatitive understanding and certain mental abilities, achievements, and attitudes. The results indicate a high achiever in quantitative understanding will also have superior intelligence, greater verbal ability, and superior achievement in reading and arithmetic. *(Janet K. Scheer)*

Neale, Daniel C. The role of attitudes in learning mathematics. The Arithmetic 1969, 16, 631-640.

Attitude toward learning math, attitudinal objectives of math instruction, relation of attitude to achievement; and some empirical data of the difference in attitude toward learning Math were discussed. The author concluded that attitude, or "intrinsic interest", does little to motivate learning. He maintained that subtantial changes in educational institutions are needed. He suggested that educators must pursue every means for making educational programs more flexible and individualized, tasks more attractive and rewarding where every motivation children have is used to encourage learning. *(Janet K. Scheer)*

Neal, E.A. & Foster, I. An experiment with remedial work in common fractions. Elementary School Journal, 1928, 29(4), 280-283.

The authors felt that a plan for the review of common fractions based on a carefully organized diagnostic and remedial material would be the most efficient. The article deals with the construction and implimentation of this plan and its results. It was found that this method of organized practice material was more economical of pupil and teacher time and more effective in maintaining skill than the usual practice provided by a teacher.

(S. Provencher)

Neuriter, Paul R. Strike up your arithmetic band: The use of rhythm in teaching arithmetic. The Arithmetic Teacher, 1957, 4(2), 64-69.

The author believes that acoustic patterns can help teach arithmetic skills. The child hears the music, discovers a pattern, relates other patterns he knows, and then can apply the patterns to a problem-solving situation. To begin with, each cardinal number would be associated with a musical sound, and then related to a numeral. Multiplication of "1 x 4" becomes one measure of four beats. Thus the children use their kinesthetic sense and sense of hearing, while they are being motivated to learn arithmetic.

(Mary Ann Rossi)

Newport, John F. Are almost all children disadvantaged in Mathematics? The Arithmetic Teacher, 1967, 14, 21-23.

Limited experiences involving number during the early years seriously limit intellectual development in the area of math in an individual, and therefore limit his potential to profit from math instruction in later years. It is believed that as soon as children are able to communicate they should have experiences that will stimulate them to think and enable them to express themselves in situations involving number. *(Janet K. Scheer)*

Novillis, Carol F. An analysis of the fraction concept into a hierarchy of selected subconcepts and the testing of the hierarchical dependencies. Journal for Research in Mathematics Education, 1976, 23(7), 131-144.

The fraction concept was analyzed into a set of 16 selected subconcepts, which were arranged into a hypothesized hierarchy. A Fraction Concept Test of 68 items, constructed to measure students' attainment of the 16 selected subconcepts was administered to 279 students in grades 4, 5, and 6. The data were analyzed by using two ratios to determine sequencing validity. 18 of the 23 dependencies in the hypothesized hierarchy were supported. On the basis of these results, it was concluded that certain stated subconcepts were prerequisite to others.

Novillis, Carol F. The effect of the length of the number line and the number of line segments in each unit segment on seventh grade students; ability to locate proper fractions on the number line. Journal of Research in Mathematics Education, 1976, 7, 131-144.

Four subconcepts of the fraction concept were defined where the length of the number line was one or two and the number line segments in each unit segment was the same as or twice the denominator of the proper fraction. A sixteen item test, constructed to measure students' attainment of the four subconcepts was administered to 382 seventh graders. When using a 2 x 2 repeated measures ANOVA, length (one) and equivalence (same number of equivalent line segments as the denominator) were significant at the .001 level; there was also a significant interaction. No definite herearchy was supported.

O'Brien, Thomas C. & Richard, June V. Interviews to assess number knowledge. The Arithmetic Teacher, 1971, 28(9), 322-326.

Reference is made to the research of Jean Piaget in which it is maintained that knowledge is a process rather than a product. The authors suggest that if such is the case, then traditional paper-and-pencil methods of assessing student abilities are less valuable for teachers than interviews which place more emphasis on thought processes than on factual information. The authors report on what they call "the first stage of an interview protocol" which was used to evaluate counting, simple addition and missing addend knowledge of first-grade pupils. Through excerpts from actual interviews, children's strategies in solving five different tasks are described. The technique is offered only as a beginning step in designing a good diagnostic interview a.strategy. The interviews were conducted as part of a larger research project; no data are reported here.

O'Bryan, Kenneth G. & Boersman, Frederic J. Eye movements, perceptual activity, and conservation development. Journal of Experimental Child Psychology, 1971, 12, 157-169.

The article discusses a study conducted by the authors to determine if eye movement pattern (EMP) correlates with Piaget's conservation stage. The subjects consisted of 92 girls ages six to ten years, conservers, nonconservers, and in-between. The results showed a substantial difference in the EMP of conservers and nonconservers. Conservers engaged in much more perceptual activity seen in the frequent shifting from one element to another. The nonconservers centered only on the dominant feature of the field missing the rest. "Morever, the data appear to support a theory of perceptual activity leading to decentration and to indicate a change in viewing strategy associated with change in conservation status (p. 157)."

(Robert Sovchik and Evelyn Steiner)

Ohlson, E. Lamonte & Mein, Lillian. The difference in level of anxiety in undergraduate mathematics and nonmathematics majors. Journal of Research in Mathematics Education, 1977, 8, 48-56.

There was no difference in the degree of anxiety possessed by undergraduate mathematics and other undergraduates in this 1973 study. Neither sex, level in college, major, GPA or ACT score was predictive of math anxiety. General anxiety was predictive of math anxiety.

(Grace M. Burton)

Otto, H. J. Remedial instruction in arithmetic. Elementary School Journal, 1927, 28, 124-133.

This report of an experimental study suggests the possibilities of diagnosis and remedial instruction in arithmetic. Nine fourth grade pupils diagnosed as having math difficulty received remedial small group instruction in problematic areas concerning fundamental operations. Immediate and delayed posttesting showed that the nine pupils had a general increase in rate and accuracy of operations studied, retained the skills and abilities developed, and showed general increase in skill after the remedial instruction was discontinued. *(C. Trueblood)*

Paschal, Billy J. Geometry for the disadvantaged. The Arithmetic Teacher, 1967, 14, 4-6.

The author found from his work with disadvantaged first grade students that their knowledge of modern math compares favorably to middle class students. However, disadvantaged students can handle spatial perspective more easily than time perspective. Thus, the author recommends introducing geometry before set to these first graders who can better comprehend the concrete, physical aspects of geometry than the high abstraction of the typical first grade mathematical concepts. Math instruction needs to be systematic and structured for these students, not incidental. *(Robert Sovchik and Evelyn Steiner)*

Peck, Donald M. & Jencks, Stanley M. Providing advantage to the disadvantaged. The Mathematics Teacher, 1973, 66, 422-425.

The article describes a college math course offered to students predicted to perform at C- level or lower. The course emphasized small group work on solving problems using geometry, college algebra, calculus, basic arithmetic and algebra. The students learned to develop their own problem-solving strategies and ask probing questions. As a result, computational skills and attitudes improved. Instead of abstract manipulation of symbols, familiar and common experiences were incorporated into the instruction. *(Robert Sovchik and Evelyn Steiner)*

Peck, Donald M. & Jencks, Stanley M. What the tests don't tell. The Arithmetic Teacher, 1974, 21, 54-56.

The authors point out that paper-pencil tests do not adequately measure comprehension of mathematical conccepts. The use of direct interaction to evaluate comprehension is advocated. The students should be encouraged to demonstrate their understanding of a concept through the organization and manipulation of familiar objects. This technique should be used as a supplement to written tests. *(Robert Sovchik and Evelyn Steiner)*

Perl, Teri. Mathematics, questions, and 'schools without failure'. The Arithmetic Teacher, 1974, 21, 669-673.

A brief description of Glasser's four types of levels of questioning is presented. Most math problems are type one questions which require memorization and learning of facts and knowledge. Type two questions allow for one or more possible correct answers. Many math games feature type three questions which direct or ask students to select one out of several correct responses. Type four questions are open-ended and non-directed. The aritcle includes examples of all the types of questions and

math games which incorporate a combination of the question types.

(*Robert Sovchik and Evelyn Steiner*)

Phillips, Jo. Basic laws for young children. The Arithmetic Teacher, 1965, 12(7), 525-532.

The article considers the commutative, associative, and distributive principles which are characteristic of the number systems used by children up to the equivalent of average sixth graders. Emphasized is the importance of the child's need to internalize each principle so that it makes sense to him, he can see its interrelationships, and he can use it in his world.

(*Linda Zimmerman*)

Pincus, Morris, et. al. If you don't know how children think, how can you help them? The Arithmetic Teacher, 1976, 22, 580-585.

The assumption that a child's mistakes in computation are caused by insufficient knowledge of the basic arithmetic facts is often erroneous. Careful analysis of errors through observation and interview is essential in order to accurately diagnose the difficulties. An elementary school mathematics committee looked for common errors for each of the basic operations, and devised a series of diagnostic exercises for children in grades 4, 5, and 6. They found that questioning children individually was the most effective diagnostic device. Difficulties that were found common to the four basic operations, as well as those that were specific to addition, subtraction, multiplication or division, are listed. Every item is followed by a number of recommendations for remediation. The committee's report emphasizes the need for understanding each child's thought processes if an effective program of individualized instruction is to take place.

(*Baxter & Graeber*)

Pinney, Grant C. Grouping by arithmetic ability--an experiment in the teaching of arithmetic. The Arithmetic Teacher, 1961, 8, 120-123.

The article discusses the results of all day grouping of fifth and sixth grade students in an elementary school. The top thirty students were placed in one class while the lower half was placed in another. After one year of grouping, the sixth graders showed more than a two-year gain in arithmetic achievement from below the national norm to above. The slower learners were given shorter assignments while the faster learners wer given enrichment activities. The authors advocate a minimum grouping for math of one hour each day.(*Robert Sovchik & Evelyn Steiner*)

Pitts, Raymond J. Relationship between functional competence in mathematics and reading grade levels, mental ability, and age. Journal of Educational Psychology, 1952, 43, 486-492.

The article describes a study conducted to determine the factors related to achievement of functional competence in mathematics. The subjects were 210 eleventh grade girls representing all levels of math ability. The highest correlation was found between gamma IQ and reading ability. Functional math competence, reading level, and mental ability were positively related. Chronological age correlated negatively with all other variables. Of all the variables, reading ability correlated highest with functional math competence. (*Robert Sovchik & Evelyn Steiner*)

Plank, Emma N. Observations on attitudes of young children toward mathematics. Mathematics Teacher, 1950, 43, 252-263.

An early treatment of what is now called mathematics anxiety, illustrated with interesting case studies. *(Grace M. Burton)*

Poffenberger, Thomas & Norton, Donald. Factors determining attitudes toward arithmetic and mathematics. The Arithmetic Teacher, 1956, 3, 113-116.

The article highlights the findings of a study of math attitudes. Parents affect or influence the attitudes and achievement of their children in mathematics through their expectations, encouragement and own attitudes. Teachers also similarly affect student attitudes. Peer relationships had little affect upon attitudes according to the results of the study. *(Robert Sovchik & Evelyn Steiner)*

Quast, W. G. On computation and drill. The Arithmetic Teacher, 1969, 16(8), 627-630.

Many students are subjected to questionable procedures which serve to undermine the learning of mathematics. Among the detrimental procedures and practices examined were: mathematics as punishment, overemphasizing speed, relating computational ability to mathematical ability, using drill as a learning device rather than as reinforcement, inflexibility in the use of algorithms, assigning too many problems of the same type, failure to recognize when performing a particular computation other skills are being practiced as well. Computation must be put in its appropriate place as part, not all of mathematics states the author. *(Linda Zimmerman)*

Ramharter, Hazel K. & Johnson, Harry C. Methods of attack used by "good" and "poor" achievers in attempting to correct errors in six types of subtraction involving fractions. Journal of Educational Research, 1949, 42, 586-597.

This paper presents data upon the likenesses and differences in good and poor sixth grade achievers in six types of subtraction involving common fractions. The study concludes that illustrations, or worked-out solutions to examples, are a worthwhile supplementary teaching aid for both good and poor achievers and should be included in textbooks, workbooks, and on classroom chalkboards for teaching by illustrative example. *(C. Trueblood)*

Rea, Robert E. & Reys, Robert E. The comprehensive mathematics inventory: An experimental instrument for assessing youngsters entering school. Journal of Educational Measurement, 1970, 7, 45-47.

Described is an instrument designed to measure quantitative ideas of young children in areas of money, vocabulary, number, geometry, pattern, identification, measurement, and recall. *(C. Trueblood)*

Rebec, Linda. A case against teaching mathematical concepts to slow-learning children. The Arithmetic Teacher, 1972, 19, 333-334.

This report identifies cases to suggest rote learning for slow learners as the teaching of concepts clouds, rather than clarifies, the learning situation for such children. It encourages teachers to use games and activities which permit drill and rote learning in interesting lessons. *(C. Trueblood)*

Reilly, Vera. Reversals in writing: Some suggestions for teachers. Teaching Exceptional Children, 1972, 4(3), 145-147.

The author lists inexperience, differences in maturity rates, mixed dominance, and difficulties in perception as possible causes of reversals in writing for young children. To eliminate reversals, the author suggests some activities which would help the child recognize differences in direction, and give the child three-dimensional and written practice using correct symbols. *(Mary Ann Rossi)*

Reisman, Fredricka K. Children's errors in telling time and a recommended teaching sequence. The Arithmetic Teacher, 1971, 18, 152-154.

This report identifies and discusses errors demonstrated in identifying time on a clockface. It suggests that errors occur as result of teaching clock time with the same techniques used to teach reading the calendar; the calendar is not a counter, the clock is. Recommended is a sequence for teaching time to the percision of a minute. Evaluative investigation has produced evidence that even first graders can learn to tell time to the minute when taught according to this learning hierarchy. *(C. Trueblood)*

Resnick, Lauren B. (Ed.). Hierarchies in children's learning: A symposium. Instructional Science, 1973, 2, 331-362.

This article, based on a 1970 symposium of the American Educational Research Association, presents an overview and analysis of the use of learning hierarchies in instruction and research, examines some current research on learning hierarchies, and considers the implications of this research for instructional psychology and for theories of cognitive development. *(C. Trueblood)*

Reys, Robert E. Mathematics, multiple embodiment, and elementary teachers. Arithmetic Teacher, 1972, 19, 489-493.

This report points to the importance of using physical materials for instruction that provide the proper embodiment of the mathematical concept being developed. An example of this approach was given by discussing multiple-embodiment approach to teaching the concept of area in a third and fourth grade class and the concept of addition through various number families. It is suggested that children work in a "hands on" type program with accompanying demonstrations where applicable. Reys states that research available concerning multiple embodiment versus a single embodiment approach to concept formation is inconclusive and neither consistently supports or refutes multiple embodiment teaching. *(C. Trueblood)*

Richardson, Frank C. & Suinn, Richard M. The mathematics anxiety rating scale: Psychometric data. Journal of Consulting Psychology, 1972, 19, 551-554.

Based on a sample of 397 college students, normative, reliability and validity data are reported for the MARS, a 98-item scale of brief descriptions relating to mathematics anxiety. High MARS scores were associated with poor performance on mathematics tests. *(Grace M. Burton)*

Riedesel, D. A. & Pikaart, L. Recent research contributions to elementary school mathematics. Arithmetic Teacher, 1970, 17, 245-252.

To complement the January 1970 issue of The Arithmetic Teacher's research report of Burns and Davis, this March 1970 project identifies

research studies conducted from the conclusion of World War II. Concerning contributions to elementary school mathematics, this presentation categorizes the studies presented as approaches to content, approaches to teaching, and materials. (*C. Trueblood*)

Riedesel, C. Alan & Suydam, Marilyn N. Research in mathematics education, grades K-8 for 1968. The Arithmetic Teacher, 1969, 16, 467-478.

Presented in this article is the twelfth of a series of annual listings of research concerned with elementary school mathematics, including annotated format for summaries, journal articles, and dissertation abstracts. (*C. Trueblood*)

Rimland, B. Effect of including extraneous numerical information in a test of arithmetic reasoning. Educational and Psychological Measurement, 1960, 20, 787-794.

Here is a report of an experiment conducted during the development of Form 6 of the Navy Arithmetic Test (ARI) to determine if including extraneous numerical information in the arithmetic reasoning items of the ARI would lower the ARI - Navy General Classification Test correlation without appreciable lowering the internal consistency of the ARI. The findings of this research do not support the inclusion of extraneous information in arithmetic reasoning items if a relatively pure homogeneous measure of arithmetic reasoning is desired, as in the case of the ARI. (*C. Trueblood*)

Roberge, James J. Recent research on the development of children's comprehension of deductive reason schemes. School Science and Mathematics, 1972, 72, 197-200.

The purpose of this article is to examine and summarize some of the findings of recent research on the development of chidlren's comprehension of deductive reasoning schemes. Discussion of the research presented in two tables focuses on eleven basic principles of inference and the percentage of students who had mastered each of the principles. Investigation results suggest the inclusion of instruction in the common schemes of inference in grades three to six and reaffirm the necessity for having instruction in the fallacies of the basic principles of inference. (*C. Trueblood*)

Roberts, G. The failure strategies of third grade arithmetic pupils. Arithmetic Teacher, 1968, 15(5), 442-446.

This article describes a study whose aim was to discover in what computational skills children were most deficient. Also studied were methods of attack on tasks which led to incorrect responses. Third graders in the Bentwood, New York public schools were used as the sample population. Four major categories of failure strategies were established and interpreted. They were: wrong operation, obvious computational error, defective algorithm and random response. Test results urge the analyzing of the pupils, method and/or lack of method for problem solving and choose proper instructional methods. (*S. Provencher*)

Robitaille, Joseph P. Qualitative evaluation. The Arithmetic Teacher, 1962, 9, 276-277.

This brief statement article suggests that teachers give credit to methodology, computation, and answer on children's mathematics

operations, rather than a total correctness or wrongness due to answer only. This method is suggested to award the child for thinking and reasoning even though final answer may be wrong. Simple going through the motions of computation without applying mathematical thinking is to be discouraged. (*C. Trueblood*)

Romberg, Thomas A. Current research in mathematics education. Review of Educational Research, 1969, 30, 473-491.

This report presents review of research in mathematics education categorizing studies into the following areas: 1.) effectiveness of instructional programs; 2.) learner aptitudes and abilities of mathematics learning; 3.) attitudes toward mathematics; and 4.) evaluation and measurement of mathematics achievement. The report concludes with statements concerning trends in research in mathematics education and predicting more and better basic, programatic research, better curriculum evaluations, and better tests developed for use in mathematics education. (*C. Trueblood*)

Ross, R. A description of twenty arithmetic underachievers. The Arithmetic Teacher, 1964, 11, 235-241.

This study was conducted in an effort to identify basic characteristics of underachievers in arithmetic with average to above average intellectual abilities. A battery of tests, interviews, screening devices were utilized. The study indicated that many students were below grade level in reading; most were underachievers in school subjects in general; many appeared to have emotional problems, short attention spans, lacked interest and/or initiative; many had abnormal physical characteristics; most parents were from lower economic classes and often held teachers responsible for the child's inadequacies; and finally their achievement in mathematics was limited to basic skills of whole number addition, subtraction, and multiplication. (*G. S. Johnson*)

Ross, Ramon. Diagnosis and correction of arithmetic underachievement. The Arithmetic Teacher, 1963, 16, 22-27.

This article gives suggestions for testing students for assessment in reading, reasoning, and computational difficulties in verbal problems involving basic whole number and fractional processes, and recommendations for remedial work with arithmetic underachievers. Checklists for identifying the difficulties and suggestions for administering the test are enumerated. Twelve suggestions for corrective instruction are listed and include diagnosing errors, using instructional packets, providing immediate feedback, giving individual attention and encouragement, using concrete-abstract devices in illustrating concepts, relating concepts to real life situations, providing a variety of drill exercises, removing distractors, encouraging independence, and testing/evaluating frequently. (*G. S. Johnson*)

Rosskopf, Myron F. Piagetian research and the school mathematics program. The Arithmetic Teacher, 1972, 19(9), 309-314.

The article deals with the Piagetian concept that a child's logic is based on his experience with and manipulation of objects, and how this concept is related to the teaching of mathematics. A classroom buzzing with activity, movement and conversation is stressed in the article but should be

balanced by quiet periods for practice work. For ages 3 to 5 years it states that the teacher should ask questions and stimulate the development of concepts. For children of age 5 to 8 the article suggests topics such as symmetry, mapping, ordered pairs, and area be presented. Finally, for the 8 to 11 year age group the article suggests more discovery techniques, using mapping and vectors in place of traditional addition and subtraction drills, filing, measurement, and a continuation of using concrete manipulatives whenever possible. *(G. S. Johnson)*

Rouda, Eileen M. Success for all: An adventure in learning. The Arithmetic Teacher, 1972, 19(6), 35-37.

This article describes the following skill development program in mathematics. Students work in groups of 4 all working to help one another Mathematic concepts are taught through games and manipulative which are made from inexpensive or donated materials. Written exercises and enrichment activities are a part of the program. It is an individualized program with reinforcement and enrichment built into the curriculum. Constant reappraisal of students is another benefit to the program resulting in the child's feelings of success. Frustration, hopelessness, and disgust with mathematics are minimized in such a program.*(G. S. Johnson)*

Rush, R. R., Brown, J. A. & Delong, A.R. Meaning of an arithmetic test score. The Arithmetic Teacher, 1962, 9, 145-148.

This article demonstrates how 35 NSF teachers can grade the same 5 item test resulting in a wide range of outcomes. The range was from 10-75 points and the grades from C- to F. Reasons given by the teachers account for the discrepancies included lack of knowledge about the student and his mathematical experiences, lack of criterion for grading, and lack of knowledge of the purpose of the test. The results showed factors influencing the grading discrepancies include teacher's judgment of the level of mathematical understanding, the correctness of the final answer, and the teacher's values in judging form and method. *(G. S. Johnson)*

Sauble, Irene. Development of ability to estimate and to compute mentally. The Arithmetic Teacher, 1955, 2, 33-39.

The article stresses the importance of developing a competence in estimating and computing mentally as it is a useful, if not necessary, tool for handling many everyday life situations. This competency requires great understanding of the background of each mathematics concept to be mastered and it develops analytical skills. The article emphasizes the need for many opportunities to be presented to students to practice estimation in the classroom that they might gain in competence and confidence in using this skill. *(G. S. Johnson)*

Savage, R. D. & O'Connor, D. J. The assessment of reading and arithmetic retardation in the school. British Journal of Educational Psychology, 1966, 36, 317-318.

This article hypothesizes that a consistent relationship exists between I.Q. and reading and arithmetic ability. Testing I.Q. with the Otis Quick Scoring Mental Ability tests, mathematic ability with the Schonell Essential Arithmetic test, and reading ability with the Watts Sentence Reading test, the intercorrelations of the test results support the proposal. The article suggests that using this information a child having abnormal

scores could be recognized and diagnosed early in his education.
(*G. S. Johnson*)

Scharf, Eugenia S. The use of the semantic differential in measuring attitudes of elementary school children toward mathematics. School Science and Mathematics, 1971, 71, 641-649.

A semantic differential attitude test was administered to 1300 subjects in grades four, five, and six who were placed in individualized (IRI) and conventional learning environments. Subjects were in IPI classes for three years. The research concluded that the instrument discriminated both grossly and specifically attitudinal differences between the two treatment groups. (*Bob Underhill*)

Schminke, Clarence W. The arithmetic folder. The Arithmetic Teacher, 1962, 9, 152-154.

The author describes techniques for individualizing evaluation on important outcomes beyond skill mastery. This continuous evaluation procedurs focuses on faculty thinking, ability to explain, and awareness of when to apply skills. (*Bob Underhill*)

Schmitt, Clara. Extreme retardation in arithmetic. Elementary School Journal, 1921, 21, 528-547.

A detailed consideration of physical and affective attributes of 34 children is presented. These children were identified as "extremely backward" in arithmetic. All subjects were of normal intelligence and were having no marked difficulty in other subjects. She concluded that educational development rather than innate attributes were causitive. (*Bob Underhill*)

Schoen, Harold L., Self-paced mathematics instruction: How effective has it been? The Arithmetic Teacher, 1976, 23(7), 90-96.

In this particular case learning packets or units were used. The students learned independantly from textbooks or worksheets. Pretests and posttests were included. The lower elementary students favored the independant study. The upper elementary students favored the controlled classroom where a teacher was in charge and made the assignments.

It was reported that in the independant study program, 88% of the students cheated.

The conclusion stated that the self-paced instruction is very expensive, and requires more work from teachers. They recommended that teacher aids or computors accompany the program. (*G. Baur and D. Pigford*)

Schonell, F. J. Learning difficulties in arithemtic: The New Era, 1938, 19, 223-227.

A period piece from one of the earliest diagnosticians. He concludes the article with these words: "If we are to help pupils who are backward in arithmetic we must accurately diagnosis their specific difficulties and we must disperse the effects of failure through success, consideration, and properly planned help." (*Grace M. Burton*)

Schultz, Edward W. The influence of teacher behavior and dyad compatibility on clinical gains in arithmetic tutoring. Journal for Research in Mathematic Education, 1972, 3, 33-41.

This study focused on the combined influence of teachers' facilitative behaviors and teacher-student compatibility on clinical tutoring outcomes.

The study included 20 teachers and 40 learners. The hypothesized relationships were not supported. *(Bob Underhill)*

Schwartz, Anthony N. Assessment of mathematical concepts of five-year-old children. The Journal of Experimental Education, 1969, 37, 67-74.

The Schwartz Early Mathematics Inventory (SEMI) was designed to evaluate the mathematical achievement of children ages three through five, by means of group administration. The data given concerned only the beginning stages of the procedure and dealt with 215 kindergartners. Eighty-one items were administered on 64 pages, and a reliability of .94 was obtained. The mean score for items correct was 43.2. The proportion of correct responses for various items ranged from .85 to .12. The physical and emotional attributes needed for completion of the inventory had been adequately acquired by the children such as turning pages, holding a pencil or crayon, recording responses in designated areas, and maintaining satisfactory attention for the 12 to 28 minutes needed for administering the three parts of the SEMI. *(T. A. Barrie)*

Schwartz, Richard H. Why many students have trouble with mathematics and what can be done about it. MATYC Journal, 1976, 10, 70-74.

Student attitudes, learning methods and problem solving methods are discussed. Suggestions for making improvements are given.

Schwartz, Robert H. & Shores, Richard E. The academic achievement of EMR students and social class. American Journal of Mental Deficiencies, 1969, 74, 338-340.

Educable mentally retarded (EMR) students enrolled in special education classes were assigned to groups on the basis of age and social class. Using Warner's scale (Warner, Meeker, and Eells, 1960) four groups were formed as combinations of high and low-social class and two age groups (9—10 years and 14—15 years). After measuring and comparing the arithmetic and reading levels of the groups, it was concluded that in general, middle-class children achieve at a higher level and that a difference in reading skills appeared to increase as a function of age and social class. *(T.A. Barrie)*

Shaw, Merville C. & McCuen, John T. The onset of academic underachievement in bright children. The Journal of Educational Psychology, 1960, 51, 103-108.

Subjects for this study were taken from a single school district and had gone all the way through school in this district. All subjects had IQ's over 110 and were grouped on the basis of sex and compared on the basis of grade-point average at every grade level from one through eleven. The subjects were grouped as Achievers or Underachievers on the basis of cumulative grade-point average they received in Grades 9, 10, and 11. The male Underachievers received grades lower than the Achievers starting in Grade 1 and at Grade 3 this difference became significant at the .01 level. The difference grew in significance every year from Grade 3 to Grade 10. In Grades 10 and 11 the difference was reduced because of a drop in the grades of the Achievers. For the first five years of school, female Underachievers exceeded Achievers in grade-point average. From Grade 6 through 11 the grade point average of female Underachievers was below

the Achievers, but the difference was smaller at Grade 11 because of a drop in grades of Achievers at that level. (*T. A. Barrie*)

Shine, Aileen. Relationship between arithmetic achievement and item performance on the revised Stanford-Binet scale. The Arithmetic Teacher, February 1961, 8(6), 57-5

Item analysis of the Revised Stanford-Binet Scale was used to determine if patterns of item response associated with high achievement in arithmetic could be identified. It was concluded that there was a definite, positive relationship between kindergarten pupils passing any item on the Revised Stanford-Binet Scale and their achievement in arithmetic. In particular, when the items were grouped according to type, such as number concepts, vocabulary, comprehension, and memory, it was concluded that all but one type of item (the copying test) correlated positively with arithmetic achievement. (*Thomas Romberg*)

Shumway, Richard J. Students should see "wrong" examples: An idea from research on learning. The Arithmetic Teacher, April 1974, 21, 344-348.

The results of research consistently favor the use of both positive and negative instances over positive instances alone in the learning of mathematical concepts such as commutativity and associativity. Several examples of ways in which positive and negative instances could be helpful in teaching mathematics are presented.

We do not know exactly why the use of both positive and negative instances is favored over the use of only positive instances for learning concepts. Further, we do not know the best balance between positive and negative instances. (Should the numbers of positive and negative instances be about equal? How many negative instances should be provided?) There seems to be reason to except that a mixture of positive and negative instances would be preferable to positive instances alone in learning other mathemtaical concepts. (*Thomas Romberg*)

Siu, Mna-Keung. Mathematics for math-haters. International Journal of Mathematics Education, Science and Technology, 1977, 8, 17-21.

Suggest a rationale and curriculum for a college mathematics course for liberal arts students who "hate mathematics". (*Grace M. Burton*)

Smith, James H. Individual variations in arithmetic. Elementary School Journal, November 1916, 17, 195-200.

The arithmetic tests used in the Cleveland Survey were given to Grades IIIB-VIIB of the Elementary School of the University of Chicago and the results were used to diagnose the points of individual weaknesses. The results showed a large amount of variation in both individuals and classes. This suggested a more detailed study of certain individuals with particular emphasis on their points of weakness. (*Thomas Romberg*)

Smith, Lehi T. and Bitter, Gary G. Cultural considerations in mathematics education in Arizona. The Arithmetic Teacher, February 1974, 21, 86-89.

Two efforts made to adapt math teaching to Mexican and Mexican-American and to Indian children in Arizona and New Mexico are reported. One was for migrant children of Mexican-American background. It began with a mathematics laboratory course that familiarized teachers with the common mathematics laboratory approaches and materials. The teachers then used the approaches and the materials in their own classes

as part of the course. A manual was developed for the teachers.
The second effort was for the Navajo Indian Tribe. Experience indicates that a more adequate job will be done in educating Indian children if the materials and the teaching approach are oriented to the unique culture of the Indian (*Thomas Romberg*)

Smith, Marsha C. Reversing reversals. Education and Training of the Mentally Retarded, 1972, 7(2), 91-93.
The article dealt with a way to help in aiding reversal problems. A list was given of exercises helpful to the teacher to begin the training of laterality, directionality and finally, the reversals themselves. Body Awareness exercises were given such as rolling, crawling, balance bean (walking board), Follow Me, Rhythms (R-L-R-L-R-L), Irregular Rhythms (R-LL-R-LL), also, exercises such as Obstacle course, identification of body parts, and the spots. Exercises to correct reversals were given such as reversal chart, ink blot, art project, kinesthetic approach, Tactile approach and mirror work. (*Janet M. Baldwin*)

Smith, Robert F. Diagnosis of pupil performance on place-value tasks. The Arithmetic Teacher, May 1973, 20, 403-407.
This is about the study described in more detail in A diagnostic study of pupil performance on a test of skills relevant to the mastery of place-value tests. (*Thomas Romberg*)

Sovchik, Robert & Heddens, James W. Classroom diagnosis and remediation. Arithmetic Teacher, 1978, 26(1), 47-49.
Procedures for classroom diagnosis that can be used by classroom teachers. Informal observations and listening, commercial or teacher-made testing each used selectively, can be effective. Remediation methods briefly discussed.

Stromer, Robert. Remediating academic deficiencies in learning disabled children. Exceptional Children, 1977, 43, 432-440.
Three experiments show successful behavioral procedures (assessment and remediation) to remediate basic academic deficiencies of L.D. children. Reversal, omission, substitution errors involved. Tutor training and small group flash card instruction showed success. Significant low cost success.

Suinn, Richard M. & Richardson, Frank. Anxiety management training: A nonspecific behavior therapy program for anxiety control. Behavior Therapy, 1971, 2, 498-510.
A conditioning procedure to reduce anxiety reactions, Anxiety Management Training (AMT), was used with 13 students. The reduction in mathematics anxiety in this population was compared with that in a population of 11 students treated with desensitization techniques and with 119 control non-anxious subjects. Reduction was significant in both treatment groups. MARS used as pre- and post-test. The anxiety level of both treatment groups fell to that of the control group. AMT does not require the construction of individual anxiety hierarchies and thus can be used more efficiently in small group settings. (*Grace M. Burton*)

Suydam, Marilyn N. & Riedesel, Alan. Research findings applicable in the classroom, Arithmetic Teacher, 1969, 16, 640-642.
List of research findings for classroom use involving the following areas: planning; strategies; attitudes; practice and reinforcement; learning levels;

basic skills; problem solving; text materials; and background factors.

(*Stephanie Rossi*)

Suydam, Marilyn N. & Riesdesel, A. Alan. Reports of research and development activities, 1957-1968. The Arithmetic Teacher, 1970, 17, 511-527.

Research on Mathematics education, grades K-8 for 1969. This is the thirteenth in the series of annual listings of research concerned with elementary school mathematics. They may serve to guide readers to those studies that are most pertinent for their needs. Each of the findings has some support within the limitations of the study on which it is based.

The listing is partitioned into three categories - summaries, journal-published reports, and dissertation abstracts-with items cited alphabetically within each category. (*Barbara Stevens*)

Swart, William L. A diary of remedial instruction in division - grade seven, Arithmetic Teacher, 1975, 22(8), 614-622.

The author was doing remedial work with two girls in the area of division.. Day by day instructional plans are given. Diagrams and samples of the girles' figuring are also given. Professor Swart's plan was to provide a new process, repeated subtraction, to use instead of the "distibutive" division which meant failue to the girls. (*G. Baur, D. Pigford*)

Szetela, Walter. The effects of test anxiety and success/failure on mathematics performance in grade eight. Journal for Research in Mathematics Education, 1973, 4, 152-160.

The Math Debilitating Anxiety Scale used in NLSMA was given to 325 eighth graders. Significant differences were found in test performance between those who had high scores and those who had low scores on the scale. Girls supported higher math text anxiety than boys did. Neither report of anxiety nor task performance under failure condition was significantly different from that under success condition. (*Grace M. Burton*)

Tobias, Sheila. Math anxiety, Ms., September, 1976, 5, 56-59.

It is alright to use different methods as long as it is correct and you are comfortable with it.

A "Math Anxiety Clinic" for undergraduates and adults was held. It claims that math anxiety is a significant handicap for most women.

A reference is made to Mitchell Lazarus, a specialist in math learning at the Ed. Devel. Center in Newton, Mass., in regard to mathophobia.

(*G. Baur, D. Pigford*)

Tobin, Alexander & Bonner, James. Elementary mathematics resource teacher program. Arithmetic Teacher, 1977, 24, 329-332.

Program explained for math resource teachers' project in Philadelphia schools to bring up low students two grade levels in one year and decrease number of scores below the median on standardized tests.

Trembley, L. & Luke, H. A model for a remedial mathematics program. The Arithmetic Teacher, 1977, 24(2), 140-144.

This article describes a model remedial mathematics program called Math Control Central (MCC) that addresses itself to both theoretical and practical dimensions involved in formulating a solution to the question, How can a public school district organize itself to significantly meet the needs of students with extensive problems in arithmetic? Described are

the program's features, theoretical rationale, personnel, project objectives, project procedure, instructional method, and evaluation.

(*Linda Zimmerman*)

Trueblood, Cecil R. A model for using diagnosis in individualizing mathematics instruction in the elementary school classroom. The Arithmetic Teacher, 1971, 18, 505-511.

Trueblood argues that the current emphasis on planning for individual differences has changed instruction from a "means-referenced" (How should I teach?) to a goal-referenced point of view. (What should I teach?) Four types of individualization are briefly described: Individually Prescribed Instruction (IPI), Personalized Instruction, Self-directed Instruction, and Independent Study. The author points out that for each of these, teachers require continuing information about the learner. A goal-referenced diagnosis model (What specific behaviors do my learners possess?) is included for classroom use of IPI. The model outlines tasks and their sequence, but no examples are given. Trueblood suggests some ways in which the model would need to be modified for the PI, SDI, and SI context. (*A. Graeber and K. Baxter*)

Tulock, Mary K. Emotional blocks in mathematics. Mathematics Teacher, 1957, 1957, 50, 572-576.

An early look at remediation for the math-anxious student. A set of fifteen still-valid steps are offered to the classroom teacher who does not wish to "lament in paralysis" the lack of mathematics understanding in seventh and eighth grade students. (*Grace M. Burton*)

Turkett, A. Keith & Purser, Jimmy V. Is grouping for mathematics instruction practicable in departmentalized mathematics classes? The Arithmetic Teacher, 1972, 19, 61-64.

A study to provide empirical evidence that would help determine the efficacy of within-class grouping in providing for the needs of individual learners in heterogeneously grouped, departmentalized mathematics classes is presented here. This work discusses grouping, scheduling, record keeping, and program goals. Research results support the use of the grouping procedure studied as many pupils gained skill in working with other children and in independent study habits; gained skill in assuming leadership roles; and progressed in their understanding and application of basic math skills. (*C. Trueblood*)

Tyler, Ralph. Needed research in mathematics education--a summary of the conference. Journal of Research and Development in Education, 1967, 1(1), 133-141.

The content of this article is a report on the conference to discuss needed research in mathematics which suggests there are varying points of focus. Some devote their major efforts to the improvement of teaching and learning of mathematics in the school, while other reports are primarily responsible for the education of mathematics teachers. Other studied are concerned chiefly with research on math education. The effort to find a common dialogue and understanding for these varying focal points sought a definition of research sufficiently comprehensive to be relevant to the several interests and attempted to identify the connection between research and improvement of mathematics teaching and learning.

(*C. Trueblood*)

Underhill, R. G. Individualized teacher preparation programs for students and faculty through a CBTE model. The Arithmetic Teacher, 1977, 24(1), 72-75.

A program of competency-based education was begun in the mathematics component of the elementary education program at the University of Houston in 1971. This program has the following characteristics: Competency-based, highly individualized, use of modules, a diagnostic model, extensive use of media, mathematics laboratory, differentiated staffing, strong clinical experiences component, broad professional base, and affective concern. The author stresses that mathematics teacher education programs that meet the needs of students and teachers can be created. Competencies are helpful in delineating goals, and modules and media are very useful tools in providing the instructional delivery system.

(*Linda Zimmerman*)

Vath, W.R. School for forgotten children. Today's Health, 1961, 39, 42-45.

The article provides a descriptive portrayal of a school called "the shield of David Institute for retarded children" as it meets the peculiar needs of the oft forgotten mentally retarded. A particular case is considered. The frustrations of his parents in seeking to provide what they could not along with the accompanying burden of daily care traced until they learn about the school. At the institute their child receives the best available professional help simultaneous with counseling for themselves to learn to deal with their own peculiar problems as the parents of a retarded child.

(*Charles Goodall*)

Vest, Floyd. Model switching found in lessons in subtraction in the elementary grades. School Science and Mathematics, 1970, 70, 407-410.

The concept of model switching is introduced by the presentation of several forms of word problems involving subtraction. These are found in published mathematics material and in teacher's exposistions. The author points out that teachers and writers who have knowledge of a catalog of models and the concept of model switching can guard against the unnecessary switching of models and be aware of switching when it occurs. Thus, learning is made easier and more efficient. (*Linda Zimmerman*)

Wade, Serena A. Parent participation as an aid to the child's learning. School Science and Mathematics, 1967, 67, 695-702.

The study dealt with the hypothesis that parental help at home would significantly increase achievement test scores in science. Participating parents were provided outlines and materials. Volunteering parents were identified as opposed to non-volunteering parents. It was found that parent help at home did indeed contribute to an advance in the science learning of their children. However, no significance was found relative to parental "volunteer" distinctions. As an addendum, the author presents an anaylsis of the socio-economic status and lifestyle of the parent groups.

(*C. Goodall*

Watman, Michael X. Five questions and answers about advanced general mathematics. The Mathematics Teacher, 1972, 65(7), 127-129.

The author laments the vain repetition of advanced material for low achievers in many school curricula. He proposes, instead of the same "hodgepodge" of topics taught the same way, that a course be offered that shows the student the need for mathematics in post highschool adult life.

Such a course, Watman envisions, should deal with the basic skills as well as introduce lively mathematics topics from the modern world. Topics should be introduced, as well, that stimulate creativity and provide variety. (*C. Goodall*)

Weaver, J. Fred. Big dividends from little interviews. The Arithmetic Teacher, 1955, 2(2), 40-47.

Improvement in mathematics instruction can be enhanced, according to Weaver, by focusing more on the process of learning rather than the product of learning. A segment of the curriculum in arithmetic was presented an elementary school class. Subsequent interviews and anaylsis established a charted thought pattern flow chart from previously "taught" facts to "untaught" facts. Weaver concludes by suggesting that all teachers would do well to periodically interview students in order to assess their levels of thinking. Such could lead to a differentiated teaching and learning program profitable to teacher and student alike. (*C. Goodall*)

Weaver, J. Fred. Differentiated instruction in arithmetic: An overview and a promising trend. Education, 1954, 1, 300-305.

Weaver decries any attempt to establish a uniform instruction program while ignoring established knowledge of quantitative abilities and contingent individual differences. He reviews somewhat in detail the variations that exist in quantitative abilities and expands the several techniques used to provide differentiated instruction. He concludes by suggesting the utilization and implementation of this latter knowledge provided by research incorporated with a planned diagnostic program in order to assure the proper "method of attack" at the appropriate level of learning for each student. (*C. Goodall*)

Weaver, J. G. Research on elementary-school mathematics--1960. The Arithmetic Teacher, 1961, 7, 253-260.

J. Fred Weaver of the Boston University School of Education presents an annual summary utilizing his own annotations of published research reports as well as doctoral dissertation abstracts for the year. Those reviewed here were for 1959-60. A concluding summary revealed that many familiar areas such as problem solving, mathematical understanding, mental arithmetic, audio visual aids and number abilities of young children had been studied. Work in the area of individual differences, particularly in relation to the gifted was seen to be on the increase. Arithmetic programs in foreign countries were seen as an area of interest in the future. See also the A.T. for October, 1961. (*C. Goodall*)

Weaver, J. Fred. Some concerns about the application of Piaget's theory and research to mathematical learning and instruction. Arithmetic Teacher, 1972, 19, 263-270.

The author explores the consequences of too zealously pursuing the Piagetian theory. He calls attention to the cultist dedication of some to Piaget's work when faced with studies that counter his theory. One area in particular surrounds the question of the sequential development of the child's topological, projective, and Euclidean ideas of space. Weaver alleges that learning accounts for development rather than the converse Piagetian order. He concludes by viewing the extension of readiness based on Piaget's stage theory of cognitive development an error on par with

that of the Committee of Seven that in 1939 projected mental age as the principle criterion of readiness for mathematics learning. (*C. Goodall*)

Weill, Bernice F. Mrs. Weill's hill: A successful subtraction method for use with the learning disabled child. Arithmetic Teacher, 1979, 26(2), 34-35.

The author presents an alternate algorithm that she has used successfully in her classroom. The algorithm is appropriate only when the minuend is greater than 10. The key to the method is adding up to the decade then to the number.

Weinstein, Laura. The zoomer class: Initial results. Exceptional Children, 1971, 38, 58-65.

This effort was based on the fact that Re-Ed evaluation children are not prepared to enter regular school and progress at the normal learning rate even though their behavior control has improved sufficiently to permit their entry on that basis. Weinstein selected eight post Re-Ed students and instigated what she calls a "zoomer class" designed to accelerate them to the academic pace of their classmates. She found the rate of academic gain for the Zoomer Class children exceeded considerably their expected rate in normal classes and especially that which one would expect from these children. (*C. Goodall*)

Weiss, Sol. Teaching mathematics to the disadvantaged, Israeli style. The Mathematics Teacher, 1973, 66, 309-315.

The article reports on how the Israeli's teach their disadvantaged students. Several conditions were noted as being necessary to their progress: 1) self-confidence, 2) high expectations from teachers, 3) more hours spent in mathematics, 4) prerequisites are kept to a minimum, 5) concepts introduced through intuition, 6) make use of the best teachers, 7) small class size. When these conditions were met, progress was noted. (*Karen Luce Gladden*)

Weiss, Sol. What mathematics shall we teach the low achiever? The Mathematics Teacher, 1969, 62, 571-575.

This author describes the method used in obtaining the results to this question. Questionnaries were sent out to leading mathematics educators. The results indicated the existence of widely conflicting views on what mathematics is most suitable for low achievers. The study and results are shown. (*Karen Luce Gladden*)

West, Tommie A. Diagnosing pupil errors: Looking for patterns. The Arithmetic Teacher, 1971, 18, 467-469.

Diagnosis that looks for patterns of errors rather than random errors should be the teacher's goal for patterns reveal the conceptual difficulties children are having, their insufficient understanding of the procedures they are trying to use. Diagnostic teaching requires four abilities: (a) distinguishing between conceptual and careless errors, (b) identifying the precise nature of the careless errors, (c) inferring the cause of the conceptual errors, and (d) prescribing remedial procedures. Samples of written work of three children are also analyzed. (*A. Graeber and K. Baxter*)

White, R. T. Indexes used in testing the validity of learning hierarchies, Journal of Research in Science Teaching, 1974, 11, 61-66.

The article discusses the shortcomings of the validity of the connections present in learning hierarchies, (using Gagne, Gutman and Walbesser

approaches) and shows them all to be unsatisfactory for one or more reasons. Included is a new approach, a test that can be applied when 2 or more questions are used for a skill. *(Karen Luce Gladden)*

Whitson, Willie E. Remedial cases in arithmetic, case 4. Peabody Journal of Education, 1930, 7, 362-372.

E. B. is a 7 year old student with an above average IQ, yet he is behind in his Arithmetic Ability. This article reports on the 6 week study which involved both diagnosis and remediation of his difficulties. At the termination of the study, a great amount of progress was noted.

(Karen Luce Gladden)

Williams, Robert. Testing for number readiness: Application of the Piagetian theory of the child's development of the concept of number. The Journal of Educational Research, 1971, 64, 394-396.

This study was designed to assess the development of the three stages of Piaget's concept of number among 96 kindergarten children. Piaget hypothesizes that this is a necessary concept for the presence of operational ability. Criterion tasks were used to assess each of the three stages. It was found that 91.7% of the children tested did not possess a mature concept of number as defined by the third stage of Piaget's theory. These results were then used as the basis for suggesting appropriate and inappropriate curriculum topics for kindergarten mathematics.

(Deborah Ambrose)

Wittrock, M.C. A generative model of mathematics learning. Journal for Research in Mathematics Education, 1974, 5, 181-196.

Meaningful learning as a result of the combination of appropriate background and the generative processing of information as applied to mathematics is the concern of this article. The implications of generative learning for increased understanding and retention in students as indicated by the results of numerous studies and recent research are presented. The recognition and utilization of several modes of learning and the role played by motivation are discussed in relation to the development of meaningful learning processes. *(Gail Sorenson)*

Wittrock, M.C. & Cook, Harold. Transfer of prior learning to verbal instruction. American Educational Research Journal, 1975, 12(4), 147-156.

This article reports on a research study conducted by M.C . Wittrock and Harold Cook. It includes a detailed description of the experimental design employed, the actual procedure and the results of the study which support the hypothesis that transfer of learning depends upon the congruence between previous learning and subsequent instruction. *(Gail Sorenson)*

Yant, Sandra L. Facing the energy crisis in a mathematics classroom. The Arithmetic Teacher, 1976, 23(8), 223-224.

Sandra Yant, a junior high mathematics teacher, gives a day to day log of activities in her classroom as they discover mathematical relationships involved in energy conservation. The class was divided into four groups, each of which had a recorder, a research person, an outside research person, and a mathematics consultant. The research person kept the group informed on news items and TV broadcasts. The outside researcher con-

ducted surveys of energy usage. The recorder kept records of the activities and the mathematics consultant familiarized the group with the mathematics in each area. The results were presented to the school board. Findings and recommendations were not presented in the paper.

(*C. Goodall*)

Zoll, Edward J. Research in programmed instruction in mathematics. The Mathematics Teacher, 1969, 62(7), 103-110.

The article, for the most part, is a review of the literature involving research relative to the effectiveness of programmed instruction in mathematics. Of ten studies reviewed, three yielded significant gains for the traditional approach. Seven indicated no significant difference between traditional and programmed instruction. Zoll concludes by recommending more research especially as related to the individual learner and his thinking process. He further notes that the alleged "plus" for programmed instruction, that is that "each individual is able to learn at his own rate," has not been statistically substantiated as significant. (*Charles Goodall*)

Zweng, Marilyn J. The fourth operation is not fundamental. Arithmetic Teacher, 1972, 16, 640-642.

Problem-solving is viewed as a major goal. Being able to compute is of very little use unless it can be appropriately applied to problem-solving.

Suggestions for teaching division were to do away with teaching measurement and partition problems in division as if children had to learn new concepts and operations to solve them. Teach these problems as applications of multiplication, therefore giving the child more opportunities to reinforce multiplication and also he has one problem structure to learn--multiplication -- rather than three -- multiplication and two interpretations of divison.

In conclusion, eliminate the teaching of division facts and spend more time on learning multiplication facts; that is inclusive of missing factors and missing products. (*Stephanie Rossi*)